AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
U	1 | 3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO (If applicable)
P00002	26-Sep-2005	V50000	

6. ISSUED BY CODE HR0011

DARPA
CMO
ATTN: ALGERIA TATE
3701 NORTH FAIRFAX DRIVE
ARLINGTON VA 22203-1714

7. ADMINISTERED BY (If other than item 6) CODE S0602A

DCMA DENVER
ORCHARD PLACE 2
SUITE 200
5975 GREENWOOD PLAZA BOULEVARD
ENGLEWOOD CO 80111-4715

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)

BALL AEROSPACE & TECHNOLOGIES CORP.
1600 COMMERCE ST
BOULDER CO 80301-1273

CODE 13993 FACILITY CODE

	9A. AMENDMENT OF SOLICITATION NO.
	9B. DATED (SEE ITEM 11)
X	10A. MOD. OF CONTRACT/ORDER NO. HR0011-05-C-0129
X	10B. DATED (SEE ITEM 13) 18-Aug-2005

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[ ] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [ ] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

See Schedule

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
X	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [X] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Modification Control Number: atate05950

(See Page 2)

(Contract HR0011-05-C0129, Modification P00002)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) (b)(6) EMAIL: algeria.tate@darpa.mil	
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	UNITED STATES OF AMERICA (b)(6) (Signature of Contracting Officer)	16C. DATE SIGNED 26-Sep-2005

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

The purpose of the modification is to incrementally fund the contract with the amount of $200,000. Therefore the total amount of funding available under the contract is increased by $200,000.00 from $418,903.00 to $618,903.00. Accordingly, make the following changes:

SECTION B - SUPPLIES OR SERVICES AND PRICES

SUBCLIN 000102 is added as follows:

CONTRACT LINE ITEM NO. (CLIN)	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	TOTAL ESTIMATED COST PLUS FIXED FEE
000102	Funding for CLIN 0001 AO No. V500/00 ACRN AB: $200,000.00			

SECTION G - CONTRACT ADMINISTRATION DATA

Summary for the Payment Office

As a result of this modification, the total funded amount for this contract is increased by $200,000.00 from $418,903.00 to $618,903.00.

Add the following line of accounting, ACRN AB, under Section G-4 - Accounting and Appropriation Data - of the contract:

ACRN AB	5753600 295 6001 671200 0000 659901 F448391 659901 (ARPA Order No. V500/00)	$200,000.00

At Section G-5 - Payment/Invoices, paragraph (a), correct the cognizant audit agency's description and address to read as follows:

Defense Contract Audit Agency
Ball Aerospace Resident Office
10055 Westmoor Drive
Westminster, CO 80021

Revise Section G-7 - Explanation of Limitation of Funds - to read as follows:

The total estimated cost plus fixed fee of this contract as set forth in Section B shall be subject to incremental funding with $618,903.00 presently available for payment and allotted under this contract (b)(4) (b)(4) The total funds allotted are expected to last through September 30, 2006. Except in accordance with the clause at FAR 52.232.22, "Limitation of Funds," no legal liability on the part of the Government for payment of any money in excess of $618,903.00 shall arise unless and until additional funds are made available by the Contracting Officer through written modification to this contract.

~ End ~

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
U	1 | 2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO (If applicable)
P00001	07-Sep-2005	U31400	

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
DARPA CMO ATTN: ALGERIA TATE 3701 NORTH FAIRFAX DRIVE ARLINGTON VA 22203-1714	HR0011	DCMA DENVER ORCHARD PLACE 2 SUITE 200 5975 GREENWOOD PLAZA BOULEVARD ENGLEWOOD CO 80111-4715	S0602A

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		9A. AMENDMENT OF SOLICITATION NO.
BALL AEROSPACE & TECHNOLOGIES CORP. 1600 COMMERCE ST BOULDER CO 80301-1273		9B. DATED (SEE ITEM 11)
	X	10A. MOD. OF CONTRACT/ORDER NO. HR0011-05-C-0129
CODE 13993 FACILITY CODE	X	10B. DATED (SEE ITEM 13) 18-Aug-2005

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer ☐ is extended, ☐ is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
X	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [X] is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Modification Control Number: atate05893

(See Page 2)

(Contract HR0011-05-C-0129, Modification No. P00001)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
		(b)(6),(b	EMAIL: algeria.tate@darpa.mil
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	16B. BY (b)(6) (Signature of Contracting Officer)	16C. DATE SIGNED 07-Sep-2005

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

The purpose of the modification is to make administrative changes to the contract. Accordingly, revise as follows:

SECTION A - SOLICITATION/CONTRACT FORM

At Block 7 of the Standard Form 26 - Name and Address of Contractor:

Delete: BALL AEROSPACE & TECHNOLOGIES CORPORATION
10 LONGS DRIVE
BROOMFIELD CO 80020-2510

Substitute: BALL AEROSPACE & TECHNOLOGIES CORP.
1600 COMMERCE ST
BOULDER CO 80301-1273

At Block 12 of the Standard Form 26 - Payment will be made by:

Add: DFAS COLUMBUS CENTER
WEST ENTITLEMENT OPERATIONS
P.O. BOX 182381
COLUMBUS OH 43218-2381

~ End ~

AWARD/CONTRACT

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 350)		RATING DO-C9	PAGE 1 OF PAGES 15
2. CONTRACT (Proc. Inst. Ident.) NO. HR0011-05-C-0129	3. EFFECTIVE DATE 18 AUG 2005	4. REQUISITION/PURCHASE REQUEST/PROJECT NO. U91400	

5. ISSUED BY CODE HR0011
DARPA
CMO
ATTN: ALGERIA TATE
3701 NORTH FAIRFAX DRIVE
ARLINGTON VA 22203-1714

6. ADMINISTERED BY (If other than item 5) CODE S2606A
DCMA DENVER
ORCHARD PLACE 2
SUITE 200
9875 GREENWOOD PLAZA BOULEVARD
ENGLEWOOD CO 80111-6715

7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, state and zip code)
BALL AEROSPACE &TECHNOLOGIES CORPORATION
10 LONGS DRIVE
BROOMFIELD CO 80020-2610

8. DELIVERY
[ ] FOB ORIGIN [X] OTHER (See below)

9. DISCOUNT FOR PROMPT PAYMENT
N/A

10. SUBMIT INVOICES 3 (4 copies unless otherwise specified) TO THE ADDRESS SHOWN IN: ITEM Section G

CODE 13993 FACILITY CODE

11. SHIP TO/MARK FOR CODE
See Schedule

12. PAYMENT WILL BE MADE BY CODE

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:
[ ] 10 U.S.C. 2304(c)( ) [ ] 41 U.S.C. 253(c)( )

14. ACCOUNTING AND APPROPRIATION DATA
See Schedule

15A. ITEM NO.	15B. SUPPLIES/ SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
	SEE SCHEDULE				

15G. TOTAL AMOUNT OF CONTRACT $750,000.00

16. TABLE OF CONTENTS

(X)	SEC.	DESCRIPTION	PAGE(S)
		PART I - THE SCHEDULE	
X	A	SOLICITATION/ CONTRACT FORM	1
X	B	SUPPLIES OR SERVICES AND PRICES/ COSTS	2
X	C	DESCRIPTION/ SPECS/ WORK STATEMENT	3
X	D	PACKAGING AND MARKING	5
X	E	INSPECTION AND ACCEPTANCE	5
X	F	DELIVERIES OR PERFORMANCE	5
X	G	CONTRACT ADMINISTRATION DATA	6
X	H	SPECIAL CONTRACT REQUIREMENTS	8
		PART II - CONTRACT CLAUSES	
X	I	CONTRACT CLAUSES	11
		PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS	
X	J	LIST OF ATTACHMENTS	15
		PART IV - REPRESENTATIONS AND INSTRUCTIONS	
	K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
	L	INSTRS., CONDS., AND NOTICES TO OFFERORS	
	M	EVALUATION FACTORS FOR AWARD	

CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. [X] CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return ___ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein.
(Attachments are listed herein.)

18. [ ] AWARD (Contractor is not required to sign this document) Your offer on Solicitation Number ___ including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

19A. NAME AND TITLE OF SIGNER (Type or print)	20A. NAME AND TITLE OF CONTRACTING OFFICER
Daniel J. Brophy, Director Defense Systems	TEL: (b)(6)
19B. NAME OF CONTRACTOR	**19C. DATE SIGNED**
BY DJ Brophy (Signature of person authorized to sign)	8/18/05
20B. BY (b)(6) (Signature of Contracting Officer)	**20C. DATE SIGNED** 8/18/05

Section B - Supplies or Services and Prices

CONTRACT LINE ITEM NO. (CLIN)	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	TOTAL ESTIMATED COST PLUS FIXED FEE
0001	X-ray Source Navigation Program	(b)(4)		$750,000.00
000101	Funding for CLIN 0001 ACRN AA: $418,903.00			
0002	Data and Reports and Other Deliverables in accordance with Section C-2 of the contract	*NSP	*NSP	*NSP
TOTAL CONTRACT CONSIDERATION: *NSP = Not Separately Priced		(b)(4)		**$750,000.00**

Section C - Descriptions and Specifications

C-1 Scope of Work

(a) The Contractor shall furnish the necessary personnel, materials, facilities, and other services as may be required to perform Contract Line Items (CLINs) 0001 and 0002, in accordance with the Statement of Work (See Attachment 1).

(b) The X-ray Source Navigation program will be performed by several contractors. These Contractors, while performing under separate contract vehicles, have a major role in the success of the program (See Attachment 2). Those Contractors (Los Alamos National Laboratory, National Institute for Standards and Technology, and Johns Hopkins University Applied Physics Laboratory) have significant roles that will impact the performance of the subject Contractor, Ball Aerospace. See Section H and Attachment 5 for performance impact.

(c) In the event of an inconsistency between the provisions of this contract and the technical proposal, the inconsistency shall be resolved by giving precedence in the following order: (1) the contract, (2) the attachments to the contract, and then (3) the technical proposal.

C-2 Deliverables

(a) The contractor shall submit the following reports and other deliverables as specified in the Contractor's Statement of Work (Attachment 1) in accordance with the delivery schedule set forth in Section F and Attachment 3. Contractor format acceptable with the exception of monthly financial report.

1. MONTHLY R&D PROGRESS, STATUS AND MANAGEMENT REPORT.

This brief narrative shall contain the following:

- For first report only: the date work actually started.
- Brief description of progress during the reporting period.
- Planned activities and milestones for next reporting period.
- Description of any major items of experimental or special equipment purchased or constructed during the reporting period.
- Notification of any changes in key personnel associated with the contract during the reporting period.
- Summary of substantive information derived from noteworthy trips, meetings, and special conferences held in connection with the contract during the reporting period.
- Summary of all problems or areas of concern.
- Summary of subcontractor(s) progress, interactions, noteworthy accomplishments.
- Related accomplishments since last report.
- Fiscal status to include reporting of summary level financial data in the following format:

MONTHLY FINANCIAL REPORT
PROGRAM FINANCIAL STATUS

WORK BREAKDOWN STRUCTURE OR TASK ELEMENT	CUMULATIVE TO DATE PLANNED EXPEND	CUMULATIVE TO DATE ACTUAL EXPEND	CUMULATIVE TO DATE % COMPL	AT COMPLETION BAC*	AT COMPLETION LRE*	REMARKS
Subtotal						
Management Reserve or Unallocated Resources						

TOTAL_____

*Budget At Completion (BAC) changes only with the amount of any scope changes (not affected by underrun/overrun)

** Latest Revised Estimate (LRE)

2. FINAL REPORT. The report shall provide a comprehensive summary of the entire research effort at the end of each phase, referencing (where applicable) previously submitted monthly status and financial reports, and interim reports (if any) and program reviews. Contractor format is acceptable.

The Final Report summary shall include:

- Task Objectives
- Technical Problems
- General Methodology (i.e., literature review, laboratory experiment(s), survey(s), etc.)
- Technical results
- Important Findings and Conclusions
- Significant Hardware/Software Development
- Special Comments
- Implications for Further Research
- Standard Form 298, Report Documentation Page
- Data Deliverable Updates

(b) Reports delivered by the Contractor in the performance of the contract shall be considered "Technical Data" as defined in the applicable Rights in Technical Data clause in Section I of this contract.

(c) Bulky reports shall be mailed by other than first-class mail unless the urgency of submission requires use of first-class mail. In this case, mail one copy first-class and the remaining copies forwarded by less than first-class mail.

(d) All papers and articles published as a result of DARPA sponsored research shall include a statement reflecting that sponsorship. A bibliography of the titles and authors of all such papers shall be included in the Final Report.

(e) The cover/title page of each of the above reports or publications prepared will have the following citation:

Sponsored by
Defense Advanced Research Projects Agency
Tactical Technology Office (TTO)
Program: X-ray Source Navigation Program
ARPA Order Nos. U314/00 , Program Code: 63287E
Issued by DARPA/CMO under Contract No. HR0011-05-C-0129

(f) The title page shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

(g) All technical reports must (1) be prepared in accordance with American National Standards Institute (ANSI) Standard Z39.18; (2) include a Standard Form 298, and (3) be marked with an appropriate distribution statement.

SECTION D Packaging and Marking

D-1 Packaging and Marking

All items shall be preserved, packaged, packed and marked in accordance with best commercial practices to meet the packing requirements of the carrier, and insure safe delivery at destination.

SECTION E Inspection and Acceptance

E-1 Inspection and Acceptance

Inspection and acceptance of the supplies or services to be furnished hereunder shall be made at destination by the receiving activity.

SECTION F Deliveries or Performance

F-1 Term of Contract

(a) The term of the basic contract, CLINs 0001 and 0002, commences on May 16, 2005 and continues through December 31, 2006 which includes the precontract cost period (See Attachment 4).

(b) On the basis of the Go/No-Go Criteria set forth in H-15, the Government shall evaluate the Contractor's performance during Phase I to determine if work will continue into Phase II.

(c) Should the Government elect to continue to Phase II with the Contractor, the Government will request a proposal which will be evaluated to use as the basis for negotiating a contract modification to continue performance.

F-2 Reports and Other Deliverables

Delivery of all reports and other deliverables (Attachment 3) shall be made to the addressees specified in Section F-3 in accordance with the following:

Description	Due Date
Monthly R&D Progress, Status and Management Report (including Financial Report)	Monthly report – beginning at the initiation of the contract plus 14 days. By the 15th of the month thereafter.
Final Report	One time, upon completion of the contract

F-3 Distribution of Reports and Other Deliverables

(a) DARPA/Contracts Management Office (CMO)
ATTN: Algeria K. Tate, Contracting Officer
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One copy of Financial Report, and cover letter for all other reports)

(b) DARPA/Tactical Technology Office (TTO)
ATTN: Dr. Darryll Pines, Contracting Officer's Representative
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One ORIGINAL of all reports/deliverables)

(c) DARPA/Tactical Technology Office (TTO)
ATTN: Jeffrey A. Smith, Assistant Director, Program Management
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One copy of Financial Report, and cover letter for all other reports can be sent via email to the address at adpm-tto@darpa.mil)

(d) DARPA/Defense Sciences Office (DSO)
ATTN: Riva Meade, Assistant Director, Program Management
3701 N. Fairfax Drive
Arlington, VA. 22203-1714
(One copy of Financial Report, and cover letter for all other reports can be sent via email to the address at adpm-dso@darpa.mil)

(d) DARPA/Administration Directorate (AD)
ATTN: Library
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One copy of Financial Report, and cover letter for all other reports)

(e) Administrative Contracting Officer
Defense Contracts Management Agency (DCMA) Denver
Orchard Place 2, Suite 200
5975 Greenwood Plaza Blvd.
Englewood, CO 80111-4715
(One copy of Financial Report, and cover letter for all other reports)

(f) Defense Technical Information Center (DTIC)
8725 John J. Kingman Road
Suite 0944
Fort Belvoir, VA 22060-0944
(If unclassified, two copy of Final Report only)

F-4 Notice Regarding Late Delivery

In the event the Contractor anticipates difficulty in complying with the contract delivery schedule, the Contractor shall immediately notify the Contracting Officer in writing, giving pertinent details, including the date by which it expects to make delivery; PROVIDED, however, that this date shall be informational only in character and the receipt thereof shall not be construed as a waiver by the Government of any contract delivery schedule, or any rights or remedies provided by law or under this contract.

SECTION G Contract Administration Data

ACCOUNTING AND APPROPRIATION DATA

ACRN AA	9750400 1320 U314 P5F40 2525 DPAC 5 5292 S12136 63287E (ARPA Order No. U314/00)	**$418,903.00**

G-1 Procuring Office Representative

The Procuring Office Representative for this contract is Ms. Algeria K. Tate, DARPA, Contracts Management Office (CMO), 3701 North Fairfax Drive, Arlington, VA 22203-1714, telephone (703) 696-2384, E-mail: algeria.tate@darpa.mil; FAX (571) 218-4670.

G-2 Delegation of Authority For Contract Administration

Defense Contract Management Agency (DCMA) Denver, as set forth in Block 6 of the Standard Form (SF) 26, is hereby designated as the Contracting Officer's authorized representative for administering this contract in accordance with current directives; however, technical cognizance is retained by DARPA because of the technical nature of the work.

G-3 Contracting Officer's Representative (COR)

(a) Dr. Darryll Pines, DARPA, Tactical Technology Office (TTO), is hereby designated the cognizant Contracting Officer's Representative (COR) who will represent the Contracting Officer in the administration of technical details within the scope of this contract including inspection and acceptance. The COR is not otherwise authorized to make any representations or commitments of any kind on behalf of the Contracting Officer or the Government. The COR does not have the authority to alter the Contractor's obligations or change the specifications in the contract.

(b) COR technical direction shall not include any direction which:

(1) Constitutes additional work outside the scope of work;

(2) Constitutes a change as defined in the Section I contract clause entitled "Changes;"

(3) In any manner causes an increase or decrease in the total price or period of performance;

(4) Changes any of the stated terms, conditions, or specifications of the contract.

(c) Notwithstanding any other provisions of this contract, the Contracting Officer is the only individual authorized to redirect the effort or in any way amend or modify any of the terms of this contract. If, as a result of technical discussions, it is desirable to alter contract obligations or statement of work, a modification must be issued in writing and signed by the Contracting Officer.

G-4 Accounting and Appropriation Data

Refer to the Accounting and Appropriate Data indicated above under Section G.

G-5 Payment/Invoices

(a) Vouchers - Original plus three (3) copies, identified by contract number, with supporting statements, shall be submitted monthly for review and provisional approval to the cognizant audit agency listed below:

Defense Contract Audit Agency
10500 Westmoor Drive
Westminster, CO 80021

(b) In addition to the above, one copy of each voucher submitted for payment shall be submitted to the Contracting Officer and the COR of this contract.

G-6 Payment Instructions for Multiple Accounting Classification Citations

Payments under contract line items funded by multiple accounting classification citations shall be made from the earliest available fiscal year funding sources. The earliest assigned ACRN must be fully disbursed before making disbursements from a succeeding ACRN.

G-7 Explanation of Limitation of Funds

The total estimated cost plus fixed fee of this contract as set forth in Section B shall be subject to incremental funding with $418,903.00 presently available for payment and allotted to this contract. (b)(4) (b)(4) The total funds allotted are expected to last through March 31, 2006. Except in accordance with the clause at FAR 52.232.22, "Limitation of Funds," no legal liability on the part of the Government for payment of any money in excess of $418,903.00 shall arise unless and until additional funds are made available by the Contracting Officer through written modification to this contract.

SECTION H Special Contract Requirements

H-1 Contracting Officer

Notwithstanding any other provision of this contract, the Contracting Officer is the only individual authorized to redirect the effort or in any way amend or modify any of the terms of this contract.

H-2 Type of Contract

This is a Cost Plus Fixed Fee, Completion contract.

H-3 Public Release or Dissemination of Information

(a) There shall be no dissemination or publication, except within and between the Contractor and any subcontractors, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval of the COR.

(b) All technical reports developed under the contract will be given proper review by appropriate authority to determine which distribution statement is to be applied prior to any distribution.

(c) When submitting material for clearance for open publication, the Contractor must submit five (5) copies to DARPA Security and Intelligence Directorate (SID) and allow for four (4) weeks for processing. If the paper is to be presented at a meeting, the contractor must indicate the subject and the exact date of the meeting, or deadline date, for submitting material. A full and final text of material requiring review, including any supplemental audiovisual material, shall be submitted. Notes, abstracts, outlines or viewgraphs shall not be cleared as substitutes for a complete text.

H-4 Invention Disclosures and Reports

The Contractor shall submit all invention disclosures and reports required by the Patent Rights clause of this contract to the Administrative Contracting Officer (ACO).

H-5 Restrictions on Printing

Unless otherwise authorized in writing by the Contracting Officer, reports, data, or other written material produced using funds provided by this contract and submitted hereunder shall be reproduced only by duplicating

processes and shall not exceed 5,000 single page reports or a total of 25,000 pages of a multiple-page report. These restrictions do not preclude the writing, editing, preparation of manuscript or reproducible copy of related illustrative materials if required as a part of this contract, or incidental printing such as forms or materials necessary to be used by the Contractor to respond to the terms of the contract.

H-6 Insurance Schedule

The Contractor shall maintain the types of insurance listed in FAR 28.307-2(a), (b) and (c), with the minimum amounts of liability therein. The types of insurance and coverage listed in paragraphs (d) and (e) shall also be maintained when applicable.

H-7 Metric System

(a) The Defense Advanced Research Projects Agency (DARPA) will consider the use of the metric system in all of its activities consistent with operational, economical, technical and safety requirements.

(b) The metric system will be considered for use in all new designs. When it is deemed not to be in the best interest of the DoD to provide metric design, justification shall be provided.

(c) Physical and operational interfaces between metric items and U.S. customary items will be designed to assure that interchangeability and interoperability will not be affected.

(d) Existing designs dimensioned in U.S. customary units will be converted to metric units only if determined to be necessary or advantageous. Unnecessary retrofit of existing systems with new metric components will be avoided where both the new metric and existing units are interchangeable and interoperable. Normally, the system of measurement in which an item is originally designed will be retained for the life of the item.

(e) During the metric transition phase hybrid metric and U.S. customary designs will be necessary and acceptable. Material components, parts, subassemblies, and semifabricated materials, which are of commercial design will be specified in metric units only when economically available and technically adequate or when it is otherwise specifically determined to be in the best interest of the Department of Defense. Bulk materials will be specified and accepted in metric units when it is expedient or economic to do so.

(f) Technical reports, studies, and position papers (except those pertaining to items dimensioned in U.S. customary units) will include metric units of measurement in addition to or in lieu of U.S. customary units. With respect to existing contracts, this requirement applies only if such documentation can be obtained without an increase in contract costs.

(g) Use of the dual dimensions (i.e., both metric and U.S. customary dimensions) on drawings will be avoided unless it is determined in specific instances that such usage will be beneficial. However, the use of tables on the document to translate dimensions from one system of measurement to the other is acceptable.

H-8 Proprietary Technical Data and Computer Software

Any deliverable technical data or computer software developed or generated solely at private expense and considered to be proprietary by the Contractor or subcontractors, shall be delivered in accordance with DFARS 252.227-7013 and DFARS 252.227-7014.

H-9 Key Personnel

(a) The Contractor shall notify the Contracting Officer prior to making any change in key personnel. Key personnel are identified as follows:

(1) Personnel identified in the proposal as key individuals to be assigned for participation in the performance of the contract;

(2) Personnel whose resumes were submitted with the proposal; or

(3) Individuals who are designated as key personnel by agreement of the Government and the Contractor during negotiations.

(b) The Contractor must notify the COR that the qualifications of prospective replacement personnel are equal to or better than the qualifications of the personnel being replaced. Notwithstanding any of the foregoing provisions, key personnel shall be furnished unless the Contractor has notified the COR of the qualifications of proposed substitute personnel, which are equal to or better than the qualifications of the personnel being replaced.

H-10 Consent to Subcontracts

Evaluation during negotiations of subcontractor cost or pricing data shall not satisfy the requirements for consent pursuant to FAR 52.244-02 Subcontracts (AUG 1998) and its Alternate I.

H-11 Travel

(a) Reimbursement for travel-related expenses shall be in accordance with the Contractor's approved travel policy. The Federal Travel Regulations, Joint Travel Regulations (JTR), and Standardized Regulations as stated in FAR 31.205-46 will be used as a guide in determining reasonableness of per diem costs. Costs for travel shall be allowable subject to the provisions of FAR 31.205-46.

(b) In connection with direct charge to the contract of travel-related expenses, the Contractor shall hold travel to the minimum required to meet the objectives of the contract, and substantial deviations from the amount of travel agreed to during contract negotiation shall not be made without the authorization of the Contracting Officer. When applicable, the Contractor shall notify the COR of proposed travel of an employee beyond that agreed to during negotiations.

(c) Approval of the Contracting Officer shall be obtained in advance for attendance by personnel at training courses, seminars, and other meetings not directly related to contract performance if the costs for the courses, seminars, and other meetings are charged to the contract.

(d) All foreign travel shall be authorized and approved in advance, in writing, by the Contracting Officer. Request for such travel must be submitted to the Contracting Officer at least forty-five (45) days in advance of traveler's anticipated departure date, and shall include traveler's itinerary of United States Flag Air Carriers.

H-12 Information Technology

(a) All Information Technology (IT) under this contract shall be "Year 2000 Compliant".

(b) IT, as used in this part, means all computer related hardware and/or software purchased and/or developed under this contract.

(c) "Year 2000 compliant," as used in this part, means, with respect to IT, that the IT accurately processes date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other IT, used in combination with the IT being acquired, properly exchanges date/time data with it.

H-13 Contractor's Representations and Certifications

The Contractor's Representations and Certifications are incorporated herein by reference and made part of this contract.

H-14 Performance Impact

In the event an Associate Contractor refuses, in writing, to deliver performance/data called for under the contract directly to the Contractor, the Contractor must notify the Contracting Officer immediately in writing upon notification from the Associate Contractor. The Contractor agrees that the Contracting Officer and Contracting Officer's Representative (COR) shall engage with the Associate Contractor to resolve pertinent issues in conjunction with the Contractor.

While the Contractor has responsibility for performance of the total X-NAV program, the Contractor shall be relieved of its obligation to furnish services relative to an Associate Contractor who fails to deliver; however, the Contractor shall work with the COR and Contracting Officer to fulfill that obligation through other venues, if possible. See Attachment 5 for performance impact based on tasks.

H-15 Go/No-Go Criteria for the XNAV team (BATC, LANL, JHU-APL, & NIST)

Phase I performance shall be evaluated on the basis of the Go/No-go criteria set forth below:

1. Successful demonstration of x-ray detector flux sensitivity (~10^{-5} to 10^{-6} ph/cm^2/s/KeV), response time (~10 to 100 ns), and timing electronics (<10 ns).

2. Successfully catalog properties of at least 10 known pulsar sources (plus any additional x-ray sources deemed useful), in the .1 to 20 KeV energy range, for use in for navigation (position and velocity), time, and attitude determination.

3. Successful demonstration of expected navigation performance via detailed laboratory simulation or hardware in the loop experiments (from ~10 m to 100 m SEP).

4. Deliverables consistent with a Preliminary Design Review (PDR) as defined in the BATC and Associate Contractor Statements of Work (SOW's). The XNAV PDR shall consist of the preliminary documents listed in the SOW, a conceptual design of the XNAV System (3-D CAD models only), and the presentation of the final report detailing the findings of the XNAV feasibility study.

5. Determine the proper orientation of the payload on the ISS Express Pallet (baseline platform) for optimum performance.

SECTION I Contract Clauses

CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	DEC 2001
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-6	Restrictions On Subcontractor Sales To The Government	JUL 1995
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 2003
52.204-2	Security Requirements	AUG 1996
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000

52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JUL 1995
52.211-15	Defense Priority And Allocation Requirements	SEP 1990
52.215-2 Alt II	Audit and Records--Negotiation (Jun 1999) - Alternate II	APR 1998
52.215-8	Order of Precedence--Uniform Contract Format	OCT 1997
52.215-10	Price Reduction for Defective Cost or Pricing Data	OCT 1997
52.215-11	Price Reduction for Defective Cost or Pricing Data--Modifications	OCT 1997
52.215-13	Subcontractor Cost or Pricing Data--Modifications	OCT 1997
52.215-14 Alt I	Integrity of Unit Prices (Oct 1997) - Alternate I	OCT 1997
52.215-15	Pension Adjustments and Asset Reversions	JAN 2004
52.215-16	Facilities Capital Cost of Money	JUN 2003
52.215-18	Reversion or Adjustment of Plans for Postretirement Benefits (PRB) Other than Pensions	OCT 1997
52.215-19	Notification of Ownership Changes	OCT 1997
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.216-7	Allowable Cost And Payment	DEC 2002
52.216-8	Fixed Fee	MAR 1997
52.219-8	Utilization of Small Business Concerns	OCT 2000
52.222-2	Payment For Overtime Premiums *(Note: The word "zero" is inserted in the blank spaces indicated by an asterisk)*	JUL 1990
52.222-3	Convict Labor	JUN 2003
52.222-21	Prohibition Of Segregated Facilities	FEB 1999
52.222-26	Equal Opportunity	APR 2002
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans	DEC 2001
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	DEC 2001
52.223-6	Drug-Free Workplace	MAY 2001
52.225-13	Restrictions on Certain Foreign Purchases	DEC 2003
52.227-1 Alt I	Authorization And Consent (Jul 1995) - Alternate I	APR 1984
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	AUG 1996
52.227-10	Filing Of Patent Applications--Classified Subject Matter	APR 1984
52.227-12	Patent Rights--Retention By The Contractor (Long Form)	JAN 1997
52.228-7	Insurance--Liability To Third Persons	MAR 1996
52.230-2	Cost Accounting Standards	APR 1998
52.230-6	Administration of Cost Accounting Standards	NOV 1999
52.232-9	Limitation On Withholding Of Payments	APR 1984
52.232-17	Interest	JUN 1996
52.232-22	Limitation Of Funds	APR 1984
52.232-23	Assignment Of Claims	JAN 1986
52.232-25	Prompt Payment	OCT 2003
52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	OCT 2003
52.233-1	Disputes	JUL 2002
52.233-3 Alt I	Protest After Award (Aug 1996) - Alternate I	JUN 1985
52.242-1	Notice of Intent to Disallow Costs	APR 1984
52.242-3	Penalties for Unallowable Costs	MAY 2001
52.242-4	Certification of Final Indirect Costs	JAN 1997
52.242-13	Bankruptcy	JUL 1995
52.242-15 Alt I	Stop-Work Order (Aug 1989) - Alternate I	APR 1984
52.243-2 Alt V	Changes--Cost-Reimbursement (Aug 1987) - Alternate V	APR 1984
52.243-6	Change Order Accounting	APR 1984
52.244-2 Alt I	Subcontracts (Aug 1998) - Alternate I	AUG 1998

52.244-5	Competition In Subcontracting	DEC 1996
52.245-5 (Dev)	Government Property (Cost-Reimbursement, Time-and-Material, and Labor-Hour Contracts) (Deviation)	JUN 2003
52.245-19	Government Property Furnished "As Is"	APR 1984
52.246-9	Inspection Of Research And Development (Short Form)	APR 1984
52.246-23	Limitation Of Liability	FEB 1997
52.247-1	Commercial Bill Of Lading Notations	APR 1984
52.247-34	F.O.B. Destination	NOV 1991
52.247-63	Preference For U.S. Flag Air Carriers	JUN 2003
52.249-6	Termination (Cost-Reimbursement)	MAY 2004
52.249-14	Excusable Delays	APR 1984
52.251-1	Government Supply Sources	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	MAR 1999
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004 Alt A	Required Central Contractor Registration Alternate A	NOV 2003
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7000	Acquisition From Subcontractors Subject To On-Site Inspection Under The Intermediate Range Nuclear Forces (INF) Treaty	NOV 1995
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Terrorist Country	MAR 1998
252.211-7003	Item Identification and Valuation	JAN 2004
252.215-7000	Pricing Adjustments	DEC 1991
252.225-7012	Preference For Certain Domestic Commodities	FEB 2003
252.225-7016	Restriction On Acquisition Of Ball and Roller Bearings	APR 2003
252.225-7025	Restriction on Acquisition of Forgings	APR 2003
252.227-7013	Rights in Technical Data--Noncommercial Items	NOV 1995
252.227-7014	Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation	JUN 1995
252.227-7015	Technical Data--Commercial Items	NOV 1995
252.227-7016	Rights in Bid or Proposal Information	JUN 1995
252.227-7019	Validation of Asserted Restrictions--Computer Software	JUN 1995
252.227-7027	Deferred Ordering Of Technical Data Or Computer Software	APR 1988
252.227-7030	Technical Data--Withholding Of Payment	MAR 2000
252.227-7036	Declaration of Technical Data Conformity	JAN 1997
252.227-7037	Validation of Restrictive Markings on Technical Data	SEP 1999
252.231-7000	Supplemental Cost Principles	DEC 1991
252.232-7003	Electronic Submission of Payment Requests	DEC 2003
252.235-7010	Acknowledgment of Support and Disclaimer	MAY 1995
252.235-7011	Final Scientific or Technical Report	SEP 1999
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.244-7000	Subcontracts for Commercial Items and Commercial Components (DoD Contracts)	MAR 2000
252.245-7001	Reports Of Government Property	MAY 1994
252.246-7000	Material Inspection And Receiving Report	MAR 2003
252.247-7023	Transportation of Supplies by Sea	MAY 2002
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000
252.251-7000	Ordering From Government Supply Sources	OCT 2002

*Remarks: At FAR 52.222, insert the word, "zero," in all spaces indicated by an asterisk (*).

CLAUSES INCORPORATED BY FULL TEXT

52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS (APR 2003)

(a) Definitions. As used this clause–

"Commercial item", has the meaning contained in the clause at 52.202-1, Definitions.

"Subcontract", includes a transfer of commercial items between divisions, subsidiaries, or affiliates of the Contractor or subcontractor at any tier.

(b) To the maximum extent practicable, the Contractor shall incorporate, and require its subcontractors at all tiers to incorporate, commercial items or nondevelopmental items as components of items to be supplied under this contract.

(c)(1) The Contractor shall insert the following clauses in subcontracts for commercial items:

(i) 52.219-8, Utilization of Small Business Concerns (OCT 2000) (15 U.S.C. 637(d)(2) and (3)), in all subcontracts that offer further subcontracting opportunities. If the subcontract (except subcontracts to small business concerns) exceeds $500,000 ($1,000,000 for construction of any public facility), the subcontractor must include 52.219-8 in lower tier subcontracts that offer subcontracting opportunities.

(ii) 52.222-26, Equal Opportunity (APR 2002) (E.O. 11246).

(iii) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era and Other Eligible Veterans (DEC 2001) (38 U.S.C. 4212(a)).

(iv) 52.222-36, Affirmative Action for Workers with Disabilities (JUN 1998) (29 U.S.C. 793).

(v) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (APR 2003) (46 U.S.C. Appx 1241 and 10 U.S.C. 2631) (flow down required in accordance with paragraph (d) of FAR clause 52.247-64).

(2) While not required, the Contractor may flow down to subcontracts for commercial items a minimal number of additional clauses necessary to satisfy its contractual obligations.

(d) The Contractor shall include the terms of this clause, including this paragraph (d), in subcontracts awarded under this contract.

52.247-67 SUBMISSION OF COMMERCIAL TRANSPORTATION BILLS TO THE GENERAL SERVICES ADMINISTRATION FOR AUDIT (JUN 1997)

(a)(1) In accordance with paragraph (a)(2) of this clause, the Contractor shall submit to the General Services Administration (GSA) for audit, legible copies of all paid freight bills/invoices, commercial bills of lading (CBL's), passenger coupons, and other supporting documents for transportation services on which the United States will assume freight charges that were paid (i) by the Contractor under a cost-reimbursement contract, and (ii) by a first-tier subcontractor under a cost-reimbursement subcontract thereunder.

(2) Cost-reimbursement Contractors shall only submit for audit those CBL's with freight shipment charges exceeding $50.00. Bills under $50.00 shall be retained on-site by the Contractor and made available for GSA on-site audits. This exception only applies to freight shipment bills and is not intended to apply to bills and invoices for any other transportation services.

(b) The Contractor shall forward copies of paid freight bills/invoices, CBL's, passenger coupons, and supporting documents as soon as possible following the end of the month, in one package to the General Services Administration, ATTN: FWA, 1800 F Street, NW, Washington, DC 20405. The Contractor shall include the paid

freight bills/invoices, CBL's, passenger coupons, and supporting documents for first-tier subcontractors under a cost-reimbursement contract. If the inclusion of the paid freight bills/invoices, CBL's, passenger coupons, and supporting documents for any subcontractor in the shipment is not practicable, the documents may be forwarded to GSA in a separate package.

(c) Any original transportation bills or other documents requested by GSA shall be forwarded promptly by the Contractor to GSA. The Contractor shall ensure that the name of the contracting agency is stamped or written on the face of the bill before sending it to GSA.

(d) A statement prepared in duplicate by the Contractor shall accompany each shipment of transportation documents. GSA will acknowledge receipt of the shipment by signing and returning the copy of the statement. The statement shall show--

(1) The name and address of the Contractor;

(2) The contract number including any alpha-numeric prefix identifying the contracting office;

(3) The name and address of the contracting office;

(4) The total number of bills submitted with the statement; and

(5) A listing of the respective amounts paid or, in lieu of such listing, an adding machine tape of the amounts paid showing the Contractor's voucher or check numbers.

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): http://www.arnet.gov/far

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any N/A (48 CFR N/A) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

SECTION J List of Documents, Exhibits and Other Attachments

Attachment 1	Statement of Work for Ball Aerospace
Attachment 2	Statement of Work for Associate Contractors
Attachment 3	Contract Deliverables Schedule
Attachment 4	Advance Agreement to Authorize Incurrence of Precontract Costs
Attachment 5	Performance Impact based on Tasks

STATEMENT OF WORK

1.0 PURPOSE AND SCOPE

1.1 Purpose

This Statement of Work (SOW) defines the effort required to manage the development of: a conceptual design and cost estimate for X-ray pulsar cataloging and modeling (Task 1); design, development, and characterization of an X-ray detection and imaging subsystem (Task 2); design and development of navigation algorithms (Task 3); and performance of integrated system design and mission studies for Phase I of the XNAV Program. The XNAV program is performed in conjunction with NIST, LANL, and JHU/APL under separate contract vehicles. Procurement requirements shall be as specified herein and in the detection and imaging
(b)(4) subsystem (b)(4) Technical Requirements Document
(b)(4) (TRD). The (b)(4) are to be designed, manufactured, and jointly tested by the Los Alamos National Laboratory, Johns Hopkins Applied Physics Laboratory, National Institute of Standards & Technology ("LANL", "JHU-APL", "NIST", or "Associate Contractors"), and Ball Aerospace & Technologies Corporation ("BATC" or "Contractor") for the Defense Advanced Projects Agency ("DARPA" or "Customer") to ultimately provide an autonomous backup navigation system for military navigation and communication satellites.

1.2 Scope

BATC agrees to furnish personnel, services, materials, equipment, and facilities necessary to develop an integrated system design and mission studies; and to assist LANL, JHU-APL, and
(b)(4) NIST in the development of a conceptual design and cost estimate for the (b)(4) pulsar cataloging and modeling, and navigation algorithm development in accordance with the requirements of this SOW and the documents referenced herein. The XNAV Program is structured in three phases:

- Phase I: Conceptual Design and Feasibility Study
- Phase II: Prototype Development and Test
- Phase III: System Development and Demonstration in Operational Environment

This SOW provides a detailed specification of the work to be performed by BATC during Phase I. Detailed statements of work for Phases II and III will be provided if requested by the Government.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this SOW to the extent specified herein. Unless a specific issue or revision is listed, the referenced documents shall be of that issue or revision in effect on the date of request for proposal:

(b)(4) • X-ray (b)(4) Technical Requirements Document (TRD) (Note: The TRD is a non-deliverable item whose content is an extraction of performance goals from the DARPA XNAV BAA. The performance estimates of the XNAV system will be continually updated and the TRD will be informally maintained.)

3.0 SPECIFIC TASKS

Reports, data, hardware, and software generated during this phase will be delivered to DARPA. For Phase I, the maturity level of the deliverable items is described in section 4.

3.1 Program Management

BATC will designate a Program Manager with authority to plan and direct the successful and timely performance of the work specified within this SOW.

Technical - System-Level
BATC, with the assistance of LANL, JHU-APL, and NIST, agrees to develop the following system-level tasks during Phase I of the XNAV Program.

3.1.1 Mission Analyses

BATC agrees to develop mission analyses, e.g., development of the system architecture, Concept of Operations (CONOPS), mission operations timelines, command & control structure, modes of communication, and contingency operations plans.

3.1.2 System Requirements Definition

BATC agrees to develop the system requirements definition, e.g., system requirements development, decomposition, and functional allocation down to the subsystem level. This information is captured in the Systems Requirement Document (SRD).

3.1.3 System Conceptual Design

BATC agrees to perform the development and evaluation of the system conceptual design, e.g., identification of critical issues, key performance parameters, and system trades associated with achieving the required overall system performance levels.

3.1.4 System Trade Studies

BATC agrees to develop the system trade studies, e.g., Modeling & Simulation (M&S) efforts, performance assessments, Cost as An Independent Variable (CAIV) studies, as applicable.

3.1.5 System Development Planning

BATC agrees to perform the system development planning, e.g., resource allocation, personnel and facilities scheduling, long-lead item identification, vendor assessment/ selection.

3.1.6 System Integration and Test Planning

BATC agrees to develop the system integration and test planning, e.g., interface definition and control, resource allocation, personnel and facilities scheduling, transportation and logistics planning, test equipment identification, special materials handling and storage.

3.1.7 System Risk Management Planning

BATC agrees to develop the system risk management planning, e.g., technology maturity assessments, system risk identification and assessments, risk reduction methods, risk probability and consequence analyses.

3.1.8 System Cost Estimation

BATC agrees to develop the system cost estimation efforts, e.g., design costs, development costs, integration and test costs, security costs, management costs, accounting costs.

3.1.9 Planning for Phases II and III

BATC agrees to develop planning for Phases II and III during Phase I, if applicable. This includes top-level feasibility and design studies.

3.2 Sub-System Level

BATC agrees to assist the Associate Contractors, LANL, JHU-APL, and NIST, in the following subsystem-level efforts for XNAV Phase I, Task 1: pulsar cataloging and modeling; Task 2, X-ray detector conceptual design, development, and characterization (b)(4) and Task 3, navigation algorithm development. BATC agrees to develop the integrated systems design and mission studies, Task 4, with the assistance of the Associate Contractors.

(b)(4)

3.2.1 Task 1: Pulsar Cataloging and Modeling

BATC agrees to assist the Associate Contractors (i.e. LANL) to perform the following:

3.2.1.1 Pulsar Catalog Generation

Compile a list of candidate navigation pulsars. The catalog will contain positions, profiles and ephemeris information for the candidate pulsars.

3.2.1.2 Pulsar Physics Limitation Characterization

Characterize any known physics limitations to the cataloged pulsars that will affect their usefulness as navigation tools. This includes characterizing timing noise, energy intensity, glitches, pulsar variations, and developing characterization models as applicable.

3.2.1.3 Pulsar Timing Model Development

Develop models that include issues associated with time transfer, relativistic effects, and inertial reference frame variations. Techniques associated with accurate pulsar profile intensity modeling will be developed to quantify pulse time of arrival, shape, phase properties, and frequency to high resolution in time.

3.2.2 Task 2: X-Ray Detector Design

BATC agrees to assist the Associate Contractors (i.e. LANL) to perform the following:

3.2.2.1 Detector Technology Selection

(b)(4)
(b)(4)

Determine which technology, (b)(4) will be pursued for the XNAV [redacted] instrument and submit a report outlining the decision. This decision will determine which technology will be studied for the remainder of Phase I studies.

b4

3.2.2.2 (b)(4) Requirements Definition
Define the (b)(4) requirements, e.g., subsystem requirements development, decomposition, and functional allocation down to the subsystem level.

3.2.2.3 (b)(4) Conceptual Design
Develop and evaluate the (b)(4) conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

3.2.2.4 (b)(4) Trade Studies
Perform (b)(4) trade studies, e.g., subsystem Modeling & Simulation (M&S) efforts, performance assessments, Cost as An Independent Variable (CAIV) studies, as applicable.

3.2.2.5 (b)(4) Development Planning
Develop plans for (b)(4) development, e.g., subsystem resource allocation, personnel and facilities scheduling, long-lead item identification, vendor assessment/selection.

3.2.2.6 (b)(4) Integration and Test Planning
Developing concepts for (b)(4) integration and test, e.g., subsystem interface definition and control, resource allocation, personnel and facilities scheduling, transportation and logistics planning, test equipment identification, special materials handling and storage. This includes the development of a draft detector flight qualification plan and draft engineering development unit (EDU) integration and test plan.

3.2.2.7 (b)(4) Risk Management Planning
Developing plans for managing (b)(4) risks, e.g., subsystem technology maturity assessments, risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

3.2.2.8 (b)(4) Cost Estimation
Develop (b)(4) cost estimates, e.g., subsystem design costs, development costs, integration and test costs, security costs, management costs, accounting costs.

3.2.2.9 (b)(4) Science Model Building and Testing
Design, build, construct, and test the operation of a laboratory science model to develop and demonstrate the feasibility of the technology chosen for the (b)(

3.2.3 Task 3: Navigation Algorithm Development
BATC agrees to assist the Associate Contractors (i.e. JHU-APL) to perform the following:

3.2.3.1 Navigation Algorithm Requirements Definition
Define the Navigation Algorithm requirements, e.g., algorithm, modeling, and simulation requirements development, decomposition, and functional allocation.

3.2.3.2 Navigation Algorithm Trade Studies

Develop navigation algorithm trade studies, e.g., determine tradeoff between orbital instability and the observation time required to detect pulsars of interest.

3.2.3.3 Navigation Algorithm Risk Management Planning

Develop plans for managing navigation algorithm development risks, e.g., risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

4.0 DELIVERABLES

BATC agrees to deliver the following to DARPA, XNAV Phase I Contract Deliverables.

4.1 Phase I, Task 4 – Integrated System Design and Mission Studies

4.1.1 Integrated System Design

BATC agrees to provide, with the Associate Contractors' assistance, the following documents. These documents shall exhibit a preliminary design consistent with the tailored PDR.

4.1.1.1 Interface Control Document

BATC will generate a preliminary Interface Control Document (ICD) to define operational, functional, mechanical, thermal, and other critical interfaces between components and software of the XNAV system design. The ICD will also address the interfaces necessary to integrate the XNAV system with the host platform, be it the baselined International Space Station (ISS) Express Pallet or a free-flyer spacecraft. Computer Aided Design (CAD) Models of the designs and layouts will be developed to identify interfaces but detailed drawings will not be included in the ICD in Phase I of the Program.

4.1.1.2 Systems Requirements Document

BATC will generate a preliminary Systems Requirements Document (SRD) to identify mission objectives and define operational and functional requirements of the XNAV system that must be met in order to achieve the objectives of this new navigational system. The SRD will also address the requirements necessary for the XNAV system to operate as specified on the host platform (the baseline is the ISS Express Pallet).

4.1.1.3 Traceability Matrix

BATC will generate a preliminary Traceability Matrix to track the allocation of operational and functional requirements and their derivatives as identified in the Systems Requirements Document for the XNAV system.

4.1.1.4 CONOPS

BATC will generate a preliminary Concept of Operations (CONOPS) document to provide a baseline approach to the mission, ground system, and operation objectives for the XNAV system. It will provide an understanding of how the mission operations system will work to plan, conduct, and evaluate program operations. This document will be revised and updated as the program progresses to capture the design and mission improvements and/or iterations that will occur during Phase I of the program.

4.1.1.5 Integration & Test Plan

BATC will generate a preliminary Integration & Test (I&T) Plan to address the integration of the subsystems and software making up the XNAV system and to test these systems independently, and as a whole, to ensure the system meets the SRD requirements verifiable by test.

4.1.1.6 Risk Mitigation Plan

BATC will generate a preliminary Risk Mitigation Plan (RMP) to address and rank the risks identified by the program as technical, programmatic, cost, and schedule risks. The RMP will identify, assess and provide mitigation strategies for all risks deemed appropriate to track by the program. This document will be revised and updated as the program progresses while retiring these risks in the appropriate phase of the program.

4.1.1.7 Detector/Imager System Design

BATC will produce a preliminary system design for the Detector/Imager System that meets the operational and functional requirements specified in the SRD. Computer Aided Design (CAD) Models of the designs and layouts will be provided but detailed drawings will not be provided in Phase I of the program. Detailed drawings will be provided in Phase II of the program

4.1.2 Mission Study

4.1.2.1 Candidate Missions Study

BATC will perform mission studies on two mission types to assess the qualitative and quantitative impacts on the X-ray navigation system performance. The utility of the XNAV system will be evaluated for a deep space mission and a low earth orbit (LEO) mission. These studies will examine such qualitative impacts as field-of-view requirements, calibration, checkout, telemetry, state-of-health monitoring, spacecraft data management, and commanding that will be required with the addition of an X-ray navigation system. Using the results of the trade and mission studies, a conceptual design will be developed for an X-ray sensor that optimizes performance for all mission types.

4.2 Phase I, Task 4, Final Report

BATC agrees to provide the Phase I Final Report (Task 4) at the conclusion of the contract. This report shall include an executive summary of the Phase I task 4 activities identified in this SOW and the set of the deliverable items defined in section 4.1. Note: The documents delivered are expected to be at preliminary level as specified in paragraph 4.1. This report may be provided at the PDR or at a later date. The final report will be provided in color hardcopy (3 copies bound and 1 unbound, each) and electronic forms (on CD-ROM), using the following formats: MS Word format for the Phase I Final Report, MS PowerPoint format for the Phase I Final Briefing, Solid Works format preferred for the Computer Aided Design (CAD) models, Adobe Illustrator format preferred for graphics, MS Project format preferred for schedules, MS Excel format preferred for costs.

4.3 Phase I, Preliminary Design Review (PDR)

BATC shall coordinate and lead a PDR at the conclusion of the Phase I contract. The XNAV PDR is defined as the following: 1) the preliminary documents listed in the BATC and Associate Contractor SOW's, 2) a conceptual design of the XNAV System (3-D CAD models only), and 3)

the presentation of the final report detailing the findings of the XNAV feasibility study. Each Associate Contractor (LANL, JHU-APL, NIST) shall present their respective findings of the Phase I feasibility study for the XNAV program. The material provided in the XNAV PDR is preliminary in design detail with the BATC deliverables identified in paragraph 4.1. All Associate Contractor deliverables are explicitly defined in their respective SOW's. Sufficient emphasis shall be given in areas (e.g. X-ray detector) needed to proceed to the next phase of the contract. Because of significant uncertainties associated with the launch vehicle selection, the payload platform (Space Station Express pallet), and the operational environment, the PDR will be constrained to conceptual designs (CAD models) of the XNAV system. Many of the typical PDR tasks and deliverables (i.e. drawings) are planned for later phases of the program. The briefing shall be available in Power Point format.

4.4 Program Reviews and Meetings

Program Kick-Off
Conceptual Design Review - CoDR
PDR - Final Report Presentation (Defined by Section 4.3)

5.0 PERFORMANCE IMPACT

BATC acknowledges that its lack of performance, to include, but not be limited to, inability to meet schedule and technical and cost requirements, will adversely affect the ability of its three Associate contractors to successfully meet their obligations in XNAV Phase I Tasks 1, 2, 3, and 4. A table of potential impacts is shown in contract Attachment #5.

~ End ~

STATEMENT OF WORK FOR ASSOCIATE CONTRACTORS

National Institute of Standards and Technology (NIST) Task Statement

The NIST research objectives for Timing and Navigation support for X-ray Source Navigation (XNAV) are to:

(1) Establish the time accuracy and stability criteria requirements for the on-board master clock for XNAV,
(2) Design the best method of profiling, defining, and time-tagging the time-of-arrival (TOA) of the defined phase center in the group velocity of received, periodic plane-wave "pulses" from pulsars, and
(3) Work with Johns Hopkins University - Applied Physics Laboratory (JHU-APL) to provide the most accurate navigation solution under various signal-to-noise constraints.

The Contractor agrees to support Ball Aerospace Technologies Corporation (BATC) with the system requirements definition; e.g., system requirements development, decomposition, and functional allocation down to the subsystem level, as follows:

1) Simulate the reception of time-tagged pulses from other pulsars using available Crab data to develop models; estimate required integration times for navigation with various high-to-marginal photon detection rates in energy range of interest. These simulations will be used to develop requirements for the space-qualified clock(s) for timing pulse arrival time,

2) Study the signal-to-noise and signal acquisition constraints, establish and track timing requirements, and define the trade-off in position accuracy. The results of this activity will be flowed to JHU-APL for use in navigation algorithm development.

The Contractor agrees to assess the XNAV mission viability of the laboratory science model developed by Los Alamos National Laboratory (LANL). NIST will act in a capacity to recommend, support, and verify on-board operational systems as constituted by BATC, LANL, and JHU-APL.

The Contractor agrees to assist LANL in their efforts to develop approaches necessary for the estimation of phase from weak pulsars.

The Contractor agrees to assist LANL in developing a method of locating, in time, the peak (or phase center) in the group velocity of received, periodic plane-wave "pulses" from pulsars.

(b)(4) The Contractor agrees to assist BATC and LANL in the development and evaluation of the [redacted] conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

The Contractor agrees to support JHU-APL by evaluating XNAV attitude, navigation, and pulsar tracking requirements and algorithms. In addition, NIST will perform a time stability analysis required for an on-board master clock versus navigation performance criteria.

The Contractor will provide recommendations to BATC for the procurement of an on-board clock system for Phase II, if applicable. This clock will be included in the on-board validation system. If there are issues that limit clock performance, other options will be evaluated.

The Contractor agrees to assist BATC in the development and evaluation of the on-board validation subsystem conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

Deliverables

The Contractor will support BATC and the associate contractors in the production of deliverable items associated with the Final Report. NIST will act as a contributing editor to the XNAV Phase I Final Report deliverable from BATC to DARPA.

The Contractor agrees to assist BATC and LANL in the delivery to BATC of a Draft Detector Design Report that contains a conceptual design for the XNAV system.

Los Alamos National Laboratory (LANL)
Task Statement

The Contractor shall:

Compile a list of candidate navigation pulsars. The catalog will contain positions, profiles and ephemeris information for the candidate pulsars.

Characterize any known physics limitations to the cataloged pulsars that will affect their usefulness as navigation tools. This includes characterizing timing noise, energy intensity, glitches, pulsar variations, and developing characterization models as applicable.

Develop models that include issues associated with time transfer, relativistic effects, and inertial reference frame variations. Techniques associated with accurate pulsar profile intensity modeling will be developed to quantify pulse time of arrival, shape, phase properties, and frequency to high resolution in time.

(b)(4) Determine which technology [redacted] will be pursued for the XNAV (b)(4) instrument and submit a report outlining the decision. This decision will determine which technology will be studied for the remainder of Phase I studies.

Define the (b)(4) requirements, e.g., subsystem requirements development, decomposition, and functional allocation down to the subsystem level.

(b)(4) Develop and evaluate the [redacted] conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

(b)(4) Perform [redacted] trade studies, e.g., subsystem Modeling & Simulation (M&S) efforts, performance assessments, Cost as An Independent Variable (CAIV) studies.

(b)(4) Develop plans for [redacted] development, e.g., subsystem resource allocation, personnel and facilities scheduling, long-lead item identification, vendor assessment/selection.

(b)(4) Develop concepts for [redacted] integration and test, e.g., subsystem interface definition and control, resource allocation, personnel and facilities scheduling, transportation and logistics planning, test equipment identification, special materials handling and storage. This includes the development of a draft detector flight qualification plan and draft engineering development unit (EDU) integration and test plan.

Develop plans for managing (b)(4) risks, e.g., subsystem technology maturity assessments, risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

Develop (b)(4) cost estimates, e.g., subsystem design costs, development costs, integration and test costs, security costs, management costs, accounting costs.

Develop representative algorithms to process data from the (b)(4) to best support the XNAV mission.

Assist with the development of the design and identification of risks involved in the readout electronics needed for the (b)(4)

Design, build, construct, and test the operation of a laboratory science model to develop and demonstrate the feasibility of the technology chosen for the (b)(4)

Deliverables

- Catalog of pulsars
- Supplemental radio observation plan
- Detector technology platform selection
- Prototype breadboard detector hardware
- Draft detector flight qualification plan
- Preliminary flight detector design

Johns Hopkins University Applied Physics Laboratory
Task Statement

I. With respect to Task 2 of Phase I of the XNAV Program, the Contractor shall:

Task APL-1. Develop a conceptual design for the readout electronics for the (b)(4) sensor that is consistent with the system requirements of the (b)(4), (b)(5)

(b)(4)

To accomplish Task APL-1, the contractor shall also:

Assist LANL and BATC in sensor (b)(4) requirements definition, trade studies, development planning, integration and test planning, risk management planning, cost estimation, data processing algorithm development, and science model building and testing.

II. With respect to Task 3 of Phase I of the XNAV Program, the Contractor shall:

Task APL-2. Develop a conceptual design for tracking signals from X-ray pulsars, and develop algorithms that will use these time difference of arrival (TDOA) measurements for spacecraft navigation. The conceptual design will be based on the use of phase-locked loop techniques, developed in conjunction with wavelet transforms under investigation by NIST, in order to coherently and synchronously track pulsars using the photon measurements provided by the (b)(4) via the sensor readout electronics.

(b)(4)

To accomplish Task APL-2, the contractor shall also:

Define the Navigation Algorithm requirements, e.g., algorithm, modeling, and simulation requirements development, decomposition, and functional allocation.

Develop navigation algorithm trade studies, e.g., determine tradeoff between orbital instability and the observation time required to detect pulsars of interest.

Develop plans for navigation algorithm development, e.g., use mathematical analysis supported by simulation using standard software tools such as Matlab, to ascertain and quantify the effectiveness of the various algorithmic approaches for use in space borne X-ray navigation systems.

Develop plans for managing navigation algorithm development risks, e.g., risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

Develop Navigation Algorithm cost estimates, e.g., design and development costs, security costs, management costs, accounting costs.

Task APL-3. Develop a conceptual design, using sensor characteristics provided by LANL, for an attitude determination algorithm based on sensor pointing angles.

To accomplish Task APL-3, the contractor shall also:

Define algorithm requirements.

Perform trade studies, development planning, risk management planning, and cost estimation.

Relate these parameters to the navigation algorithms developed in Task 1 for time difference of arrival measurements.

Task APL-4. Develop prototype demonstration software for the TDOA and Attitude Determination Algorithms.

To accomplish Task APL-4, the contractor shall also:

Design a conceptual architecture for the software required to execute the navigation and attitude determination algorithms developed during Phase I.

Develop prototype software, as indicated in a Software Development Plan, to demonstrate for the purposes of Phase I, the ability to ultimately develop flight software for a spacecraft demonstration in Phases II and III, if applicable. The prototype software will demonstrate the utility and scalability of the conceptual architecture when used to process data obtained from the (b)(4) (b)(4)

Develop a conceptual design for extensions to the navigation algorithms. These extensions will smooth noise and further improve the navigation performance of the conceptual X-ray navigation algorithms.

Task APL-5. Implement the conceptual TDOA algorithm design, in hardware and/or software, for the purpose of enabling a time difference of arrival test using measured data from an X-ray sensor that detects a simulated pulsar signal.

Deliverables

- Conceptual Readout Electronics Design Plan.
- Conceptual Readout Electronics Design Final Report.
- Conceptual Navigation Algorithms Report, detailing pulsars of interest as a function of orbital parameters, and computations of expected pulsar signals based on the (b)(4) specifications and characteristics of known Xray pulsars.
- Software Development Plan for attitude and TDOA measurements
- Pulsar Tracking Algorithms Report, including algorithms based on TDOA measurements.
- Software Architecture Report for TDOA measurements, including optimized versions using Kalman filter or other optimized techniques.
- Attitude Navigation Algorithms Report,including mapping of S/C position & time to sensor pointing angles.
- Experimental hardware and/or software for end-to-end demonstration of TDOA capabilities using X-ray sensor measurements of a simulated X-ray pulsar.
- Optimized Navigation Algorithms Final Report, included aided and non-aided acquisition and reacquisition of signals from X-ray pulsars, and a test plan for the end-to-end experiment described in Task 6 above.

~ End ~

DELIVERABLES

TITLE	DUE DATE (MONTHS AFTER AWARD)
Preliminary Interface Control Document	October 15, 2006
Preliminary Systems Requirements Document	October 15, 2006
Preliminary Traceability Matrix	October 15, 2006
Preliminary CONOPS	October 15, 2006
Preliminary Integration and Test Plan	October 15, 2006
Preliminary Risk Mitigation Plan	October 15, 2006
Preliminary Detector/Imager System Design	October 15, 2006
Preliminary Candidate Missions Study	October 15, 2006

ADVANCE AGREEMENT TO AUTHORIZE INCURRENCE OF PRECONTRACT COSTS UNDER CONTRACT NUMBER HR0011-05-C-0129

The subject Precontract Cost Agreement is extended through July 31, 2005. All other terms and conditions remain unchanged.

July 1, 2005
DATE

(b)(6)
Contract Manager
Defense Operations

7/6/05
DATE

(b)(6)
Contracting Officer

ADVANCE AGREEMENT TO AUTHORIZE INCURRENCE OF PRE-AWARD COSTS

REFERENCE: Ball Aerospace and Technologies Corporation's Proposal entitled, "X-ray Source Navigation for Autonomous Position Determination Program (XNAV)," dated October 18, 2004

Defense Advanced Research Projects Agency (DARPA), Contracts Management Office (CMO), has received a valid and properly funded requirement for Ball Aerospace and Technologies Corporation to research and demonstrate X-ray Source Navigation for Autonomous Position Determination Program (XNAV), Phase I.

Since the Contracting Officer has determined that incurrence of costs before the effective date of the contract is necessary to ensure compliance with the proposed delivery schedule, the Government and the Contractor agree as follows:

FIRST: In the event a contract is awarded, pre-award costs, not to exceed $100,000 shall be allowable expense, provided that the individual costs therein shall be

(a) otherwise allowable, reasonable, and allocable;
(b) incurred no sooner than May 17, 2005 and no later than June 30, 2005; and
(c) incurred specifically and exclusively to accomplish work described in the Statement of Work contained in the above referenced proposal.

SECOND: Contract specifications and price(s) shall be agreed to by the earlier of:

(a) June 30, 2005; or,
(b) the date on which the amount of funds obligated, committed or expended under this Advance Agreement is equal to no more than $100,000.

THIRD AND FINALLY: It is the intention of the Government to award a contract to the Contractor, subject to final agreement on terms, specifications and price(s), which contract shall incorporate this Advance Agreement. It is understood and agreed by both parties that this Agreement concerns the treatment of pre-award costs **in the event of award of a contract**. This Agreement does not require the Contractor to incur any such costs, and any costs incurred are at the risk of the Contractor, pending the award of a contract.

For the Contractor:

J. Michael Cerneck
VP & GM Defense Operations

5/19/05
(Date)

For the Government:

(b)(6)

Defense Advanced Research Projects Agency
Contracts Management Office

5/26/05
(Date)

PERFORMANCE IMPACT PER TASK

TASK	RESPONSIBILITY	ASSISTANCE REQUIRED	DELIVERABLE	IMPACT OF FAILED ASSISTANCE
Interface Definitions	BATC	ALL	Preliminary Interface Control Document	BATC is dependent upon the three Associate Contractors (AC's) to Identify Interface Information. Minimal work can be accomplished without this information.
System Requirements Definition	BATC	ALL	Preliminary Systems Requirements Document	The AC's will provide subsystem and system requirements to BATC. These will be tracked against the program KPP's. BATC will be prevented from tracking the system performance without the AC's support.
Requirements Traceability	BATC	ALL	Preliminary Traceability Matrix	See note above
CONOPS Development	BATC	ALL	Preliminary CONOPS	A notional CONOPS can be developed independent of the AC's. However, without their assistance BATC cannot provide a fully coordinated, system level CONOPS approach.
Integration and Test Planning	BATC	ALL	Preliminary Integration and Test Plan	A notional I&T Plan can be developed Independent of the AC's. However, without their assistance BATC cannot provide an adequately detailed I&T Plan for the XNAV system.
Risk Assessment and Mitigation	BATC	ALL	Preliminary Risk Mitigation Plan	BATC can identify some of the Risks associated with the X-ray sensor system. However, without the AC's assistance, BATC cannot identify all of the risks or provide detailed mitigation plans.
Draft Detector/Imager System Design	BATC	ALL	Preliminary Detector/Imager System Design	BATC can formulate a conceptual Detector/Imager system design. However without the AC's assistance BATC cannot identify all of the design parameters or provide subsystem information.
Candidate Mission Analysis	BATC	ALL	Preliminary Candidate Missions Study	This task has some dependence to the CONOPS development and the instrument performance. The analysis cannot be adequately completed without the AC's assistance.
Final Report	BATC	ALL	Final Report	BATC is dependent upon the AC's for a majority of information contained in the final report. Minimal work can be accomplished without their assistance.
Preliminary Design Review (PDR)	BATC	ALL	PDR Presentation	Same as final report note (The PDR submissions is limited to the deliverables identified in the respective AC SOW's)

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
U	1 | 3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO (If applicable)
P00002	26-Sep-2005	V50000	

6. ISSUED BY CODE HR0011

DARPA
CMO
ATTN: ALGERIA TATE
3701 NORTH FAIRFAX DRIVE
ARLINGTON VA 22203-1714

7. ADMINISTERED BY (If other than item 6) CODE S0602A

DCMA DENVER
ORCHARD PLACE 2
SUITE 200
5975 GREENWOOD PLAZA BOULEVARD
ENGLEWOOD CO 80111-4715

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)

BALL AEROSPACE & TECHNOLOGIES CORP.
1600 COMMERCE ST
BOULDER CO 80301-1273

CODE 13993 FACILITY CODE

	9A. AMENDMENT OF SOLICITATION NO.
	9B. DATED (SEE ITEM 11)
X	10A. MOD. OF CONTRACT/ORDER NO. HR0011-05-C-0129
X	10B. DATED (SEE ITEM 13) 18-Aug-2005

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[ ] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [ ] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

See Schedule

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
X	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [X] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Modification Control Number: atate05950

(See Page 2)

(Contract HR0011-05-C0129, Modification P00002)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) (b)(6) EMAIL: algeria.tate@darpa.mil	
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	UNITED STATES OF AMERICA (b)(6) (Signature of Contracting Officer)	16C. DATE SIGNED 26-Sep-2005

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

The purpose of the modification is to incrementally fund the contract with the amount of $200,000. Therefore the total amount of funding available under the contract is increased by $200,000.00 from $418,903.00 to $618,903.00. Accordingly, make the following changes:

SECTION B - SUPPLIES OR SERVICES AND PRICES

SUBCLIN 000102 is added as follows:

CONTRACT LINE ITEM NO. (CLIN)	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	TOTAL ESTIMATED COST PLUS FIXED FEE
000102	Funding for CLIN 0001 AO No. V500/00 ACRN AB: $200,000.00			

SECTION G - CONTRACT ADMINISTRATION DATA

Summary for the Payment Office

As a result of this modification, the total funded amount for this contract is increased by $200,000.00 from $418,903.00 to $618,903.00.

Add the following line of accounting, ACRN AB, under Section G-4 - Accounting and Appropriation Data - of the contract:

ACRN AB	5753600 295 6001 671200 0000 659901 F448391 659901 (ARPA Order No. V500/00)	$200,000.00

At Section G-5 - Payment/Invoices, paragraph (a), correct the cognizant audit agency's description and address to read as follows:

Defense Contract Audit Agency
Ball Aerospace Resident Office
10055 Westmoor Drive
Westminster, CO 80021

Revise Section G-7 - Explanation of Limitation of Funds - to read as follows:

The total estimated cost plus fixed fee of this contract as set forth in Section B shall be subject to incremental funding with $618,903.00 presently available for payment and allotted under this contract (b)(4) (b)(4) The total funds allotted are expected to last through September 30, 2006. Except in accordance with the clause at FAR 52.232.22, "Limitation of Funds," no legal liability on the part of the Government for payment of any money in excess of $618,903.00 shall arise unless and until additional funds are made available by the Contracting Officer through written modification to this contract.

~ End ~

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
U	1 | 2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO (If applicable)
P00001	07-Sep-2005	U31400	

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
DARPA CMO ATTN: ALGERIA TATE 3701 NORTH FAIRFAX DRIVE ARLINGTON VA 22203-1714	HR0011	DCMA DENVER ORCHARD PLACE 2 SUITE 200 5975 GREENWOOD PLAZA BOULEVARD ENGLEWOOD CO 80111-4715	S0602A

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		9A. AMENDMENT OF SOLICITATION NO.
BALL AEROSPACE & TECHNOLOGIES CORP. 1600 COMMERCE ST BOULDER CO 80301-1273		9B. DATED (SEE ITEM 11)
	X	10A. MOD. OF CONTRACT/ORDER NO. HR0011-05-C-0129
CODE 13993 FACILITY CODE	X	10B. DATED (SEE ITEM 13) 18-Aug-2005

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer ☐ is extended, ☐ is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
X	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [X] is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
Modification Control Number: atate05893

(See Page 2)

(Contract HR0011-05-C-0129, Modification No. P00001)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
		(b)(6),(b	EMAIL: algeria.tate@darpa.mil
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	16B. BY (b)(6) (Signature of Contracting Officer)	16C. DATE SIGNED 07-Sep-2005

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

The purpose of the modification is to make administrative changes to the contract. Accordingly, revise as follows:

SECTION A - SOLICITATION/CONTRACT FORM

At Block 7 of the Standard Form 26 - Name and Address of Contractor:

Delete: BALL AEROSPACE & TECHNOLOGIES CORPORATION
10 LONGS DRIVE
BROOMFIELD CO 80020-2510

Substitute: BALL AEROSPACE & TECHNOLOGIES CORP.
1600 COMMERCE ST
BOULDER CO 80301-1273

At Block 12 of the Standard Form 26 - Payment will be made by:

Add: DFAS COLUMBUS CENTER
WEST ENTITLEMENT OPERATIONS
P.O. BOX 182381
COLUMBUS OH 43218-2381

~ End ~

AWARD/CONTRACT

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 350)		RATING DO-C9	PAGE 1 OF PAGES 15
2. CONTRACT (Proc. Inst. Ident.) NO. HR0011-05-C-0129	3. EFFECTIVE DATE 18 AUG 2005	4. REQUISITION/PURCHASE REQUEST/PROJECT NO. U91400	

5. ISSUED BY CODE HR0011
DARPA
CMO
ATTN: ALGERIA TATE
3701 NORTH FAIRFAX DRIVE
ARLINGTON VA 22203-1714

6. ADMINISTERED BY (If other than item 5) CODE S2606A
DCMA DENVER
ORCHARD PLACE 2
SUITE 200
9875 GREENWOOD PLAZA BOULEVARD
ENGLEWOOD CO 80111-6715

7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, state and zip code)
BALL AEROSPACE &TECHNOLOGIES CORPORATION
10 LONGS DRIVE
BROOMFIELD CO 80020-2610

8. DELIVERY
[ ] FOB ORIGIN [X] OTHER (See below)

9. DISCOUNT FOR PROMPT PAYMENT
N/A

10. SUBMIT INVOICES 3 (4 copies unless otherwise specified) TO THE ADDRESS SHOWN IN: ITEM Section G

CODE 13993 FACILITY CODE

11. SHIP TO/MARK FOR CODE
See Schedule

12. PAYMENT WILL BE MADE BY CODE

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:
[ ] 10 U.S.C. 2304(c)( ) [ ] 41 U.S.C. 253(c)( )

14. ACCOUNTING AND APPROPRIATION DATA
See Schedule

15A. ITEM NO.	15B. SUPPLIES/ SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
	SEE SCHEDULE				

15G. TOTAL AMOUNT OF CONTRACT $750,000.00

16. TABLE OF CONTENTS

(X)	SEC.	DESCRIPTION	PAGE(S)
		PART I - THE SCHEDULE	
X	A	SOLICITATION/ CONTRACT FORM	1
X	B	SUPPLIES OR SERVICES AND PRICES/ COSTS	2
X	C	DESCRIPTION/ SPECS/ WORK STATEMENT	3
X	D	PACKAGING AND MARKING	5
X	E	INSPECTION AND ACCEPTANCE	5
X	F	DELIVERIES OR PERFORMANCE	5
X	G	CONTRACT ADMINISTRATION DATA	6
X	H	SPECIAL CONTRACT REQUIREMENTS	8
		PART II - CONTRACT CLAUSES	
X	I	CONTRACT CLAUSES	11
		PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS	
X	J	LIST OF ATTACHMENTS	15
		PART IV - REPRESENTATIONS AND INSTRUCTIONS	
	K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
	L	INSTRS., CONDS., AND NOTICES TO OFFERORS	
	M	EVALUATION FACTORS FOR AWARD	

CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. [X] CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return ___ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein.
(Attachments are listed herein.)

18. [ ] AWARD (Contractor is not required to sign this document) Your offer on Solicitation Number ___ including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

19A. NAME AND TITLE OF SIGNER (Type or print)	20A. NAME AND TITLE OF CONTRACTING OFFICER
Daniel J. Brophy, Director Defense Systems	TEL: (b)(6)
19B. NAME OF CONTRACTOR	**19C. DATE SIGNED**
BY DJ Brophy (Signature of person authorized to sign)	8/18/05
20B. BY (b)(6) (Signature of Contracting Officer)	**20C. DATE SIGNED** 8/18/05

Section B - Supplies or Services and Prices

CONTRACT LINE ITEM NO. (CLIN)	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	TOTAL ESTIMATED COST PLUS FIXED FEE
0001	X-ray Source Navigation Program	(b)(4)		$750,000.00
000101	Funding for CLIN 0001 ACRN AA: $418,903.00			
0002	Data and Reports and Other Deliverables in accordance with Section C-2 of the contract	*NSP	*NSP	*NSP
TOTAL CONTRACT CONSIDERATION: *NSP = Not Separately Priced		(b)(4)		**$750,000.00**

Section C - Descriptions and Specifications

C-1 Scope of Work

(a) The Contractor shall furnish the necessary personnel, materials, facilities, and other services as may be required to perform Contract Line Items (CLINs) 0001 and 0002, in accordance with the Statement of Work (See Attachment 1).

(b) The X-ray Source Navigation program will be performed by several contractors. These Contractors, while performing under separate contract vehicles, have a major role in the success of the program (See Attachment 2). Those Contractors (Los Alamos National Laboratory, National Institute for Standards and Technology, and Johns Hopkins University Applied Physics Laboratory) have significant roles that will impact the performance of the subject Contractor, Ball Aerospace. See Section H and Attachment 5 for performance impact.

(c) In the event of an inconsistency between the provisions of this contract and the technical proposal, the inconsistency shall be resolved by giving precedence in the following order: (1) the contract, (2) the attachments to the contract, and then (3) the technical proposal.

C-2 Deliverables

(a) The contractor shall submit the following reports and other deliverables as specified in the Contractor's Statement of Work (Attachment 1) in accordance with the delivery schedule set forth in Section F and Attachment 3. Contractor format acceptable with the exception of monthly financial report.

1. MONTHLY R&D PROGRESS, STATUS AND MANAGEMENT REPORT.

This brief narrative shall contain the following:

- For first report only: the date work actually started.
- Brief description of progress during the reporting period.
- Planned activities and milestones for next reporting period.
- Description of any major items of experimental or special equipment purchased or constructed during the reporting period.
- Notification of any changes in key personnel associated with the contract during the reporting period.
- Summary of substantive information derived from noteworthy trips, meetings, and special conferences held in connection with the contract during the reporting period.
- Summary of all problems or areas of concern.
- Summary of subcontractor(s) progress, interactions, noteworthy accomplishments.
- Related accomplishments since last report.
- Fiscal status to include reporting of summary level financial data in the following format:

MONTHLY FINANCIAL REPORT
PROGRAM FINANCIAL STATUS

WORK BREAKDOWN STRUCTURE OR TASK ELEMENT	CUMULATIVE TO DATE PLANNED EXPEND	CUMULATIVE TO DATE ACTUAL EXPEND	CUMULATIVE TO DATE % COMPL	AT COMPLETION BAC*	AT COMPLETION LRE*	REMARKS
Subtotal						
Management Reserve or Unallocated Resources						

TOTAL_____

*Budget At Completion (BAC) changes only with the amount of any scope changes (not affected by underrun/overrun)

** Latest Revised Estimate (LRE)

2. FINAL REPORT. The report shall provide a comprehensive summary of the entire research effort at the end of each phase, referencing (where applicable) previously submitted monthly status and financial reports, and interim reports (if any) and program reviews. Contractor format is acceptable.

The Final Report summary shall include:

- Task Objectives
- Technical Problems
- General Methodology (i.e., literature review, laboratory experiment(s), survey(s), etc.)
- Technical results
- Important Findings and Conclusions
- Significant Hardware/Software Development
- Special Comments
- Implications for Further Research
- Standard Form 298, Report Documentation Page
- Data Deliverable Updates

(b) Reports delivered by the Contractor in the performance of the contract shall be considered "Technical Data" as defined in the applicable Rights in Technical Data clause in Section I of this contract.

(c) Bulky reports shall be mailed by other than first-class mail unless the urgency of submission requires use of first-class mail. In this case, mail one copy first-class and the remaining copies forwarded by less than first-class mail.

(d) All papers and articles published as a result of DARPA sponsored research shall include a statement reflecting that sponsorship. A bibliography of the titles and authors of all such papers shall be included in the Final Report.

(e) The cover/title page of each of the above reports or publications prepared will have the following citation:

Sponsored by
Defense Advanced Research Projects Agency
Tactical Technology Office (TTO)
Program: X-ray Source Navigation Program
ARPA Order Nos. U314/00 , Program Code: 63287E
Issued by DARPA/CMO under Contract No. HR0011-05-C-0129

(f) The title page shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

(g) All technical reports must (1) be prepared in accordance with American National Standards Institute (ANSI) Standard Z39.18; (2) include a Standard Form 298, and (3) be marked with an appropriate distribution statement.

SECTION D Packaging and Marking

D-1 Packaging and Marking

All items shall be preserved, packaged, packed and marked in accordance with best commercial practices to meet the packing requirements of the carrier, and insure safe delivery at destination.

SECTION E Inspection and Acceptance

E-1 Inspection and Acceptance

Inspection and acceptance of the supplies or services to be furnished hereunder shall be made at destination by the receiving activity.

SECTION F Deliveries or Performance

F-1 Term of Contract

(a) The term of the basic contract, CLINs 0001 and 0002, commences on May 16, 2005 and continues through December 31, 2006 which includes the precontract cost period (See Attachment 4).

(b) On the basis of the Go/No-Go Criteria set forth in H-15, the Government shall evaluate the Contractor's performance during Phase I to determine if work will continue into Phase II.

(c) Should the Government elect to continue to Phase II with the Contractor, the Government will request a proposal which will be evaluated to use as the basis for negotiating a contract modification to continue performance.

F-2 Reports and Other Deliverables

Delivery of all reports and other deliverables (Attachment 3) shall be made to the addressees specified in Section F-3 in accordance with the following:

Description	Due Date
Monthly R&D Progress, Status and Management Report (including Financial Report)	Monthly report – beginning at the initiation of the contract plus 14 days. By the 15th of the month thereafter.
Final Report	One time, upon completion of the contract

F-3 Distribution of Reports and Other Deliverables

(a) DARPA/Contracts Management Office (CMO)
ATTN: Algeria K. Tate, Contracting Officer
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One copy of Financial Report, and cover letter for all other reports)

(b) DARPA/Tactical Technology Office (TTO)
ATTN: Dr. Darryll Pines, Contracting Officer's Representative
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One ORIGINAL of all reports/deliverables)

(c) DARPA/Tactical Technology Office (TTO)
ATTN: Jeffrey A. Smith, Assistant Director, Program Management
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One copy of Financial Report, and cover letter for all other reports can be sent via email to the address at adpm-tto@darpa.mil)

(d) DARPA/Defense Sciences Office (DSO)
ATTN: Riva Meade, Assistant Director, Program Management
3701 N. Fairfax Drive
Arlington, VA. 22203-1714
(One copy of Financial Report, and cover letter for all other reports can be sent via email to the address at adpm-dso@darpa.mil)

(d) DARPA/Administration Directorate (AD)
ATTN: Library
3701 N. Fairfax Drive
Arlington, VA 22203-1714
(One copy of Financial Report, and cover letter for all other reports)

(e) Administrative Contracting Officer
Defense Contracts Management Agency (DCMA) Denver
Orchard Place 2, Suite 200
5975 Greenwood Plaza Blvd.
Englewood, CO 80111-4715
(One copy of Financial Report, and cover letter for all other reports)

(f) Defense Technical Information Center (DTIC)
8725 John J. Kingman Road
Suite 0944
Fort Belvoir, VA 22060-0944
(If unclassified, two copy of Final Report only)

F-4 Notice Regarding Late Delivery

In the event the Contractor anticipates difficulty in complying with the contract delivery schedule, the Contractor shall immediately notify the Contracting Officer in writing, giving pertinent details, including the date by which it expects to make delivery; PROVIDED, however, that this date shall be informational only in character and the receipt thereof shall not be construed as a waiver by the Government of any contract delivery schedule, or any rights or remedies provided by law or under this contract.

SECTION G Contract Administration Data

ACCOUNTING AND APPROPRIATION DATA

ACRN AA	9750400 1320 U314 P5F40 2525 DPAC 5 5292 S12136 63287E (ARPA Order No. U314/00)	**$418,903.00**

G-1 Procuring Office Representative

The Procuring Office Representative for this contract is Ms. Algeria K. Tate, DARPA, Contracts Management Office (CMO), 3701 North Fairfax Drive, Arlington, VA 22203-1714, telephone (703) 696-2384, E-mail: algeria.tate@darpa.mil; FAX (571) 218-4670.

G-2 Delegation of Authority For Contract Administration

Defense Contract Management Agency (DCMA) Denver, as set forth in Block 6 of the Standard Form (SF) 26, is hereby designated as the Contracting Officer's authorized representative for administering this contract in accordance with current directives; however, technical cognizance is retained by DARPA because of the technical nature of the work.

G-3 Contracting Officer's Representative (COR)

(a) Dr. Darryll Pines, DARPA, Tactical Technology Office (TTO), is hereby designated the cognizant Contracting Officer's Representative (COR) who will represent the Contracting Officer in the administration of technical details within the scope of this contract including inspection and acceptance. The COR is not otherwise authorized to make any representations or commitments of any kind on behalf of the Contracting Officer or the Government. The COR does not have the authority to alter the Contractor's obligations or change the specifications in the contract.

(b) COR technical direction shall not include any direction which:

(1) Constitutes additional work outside the scope of work;

(2) Constitutes a change as defined in the Section I contract clause entitled "Changes;"

(3) In any manner causes an increase or decrease in the total price or period of performance;

(4) Changes any of the stated terms, conditions, or specifications of the contract.

(c) Notwithstanding any other provisions of this contract, the Contracting Officer is the only individual authorized to redirect the effort or in any way amend or modify any of the terms of this contract. If, as a result of technical discussions, it is desirable to alter contract obligations or statement of work, a modification must be issued in writing and signed by the Contracting Officer.

G-4 Accounting and Appropriation Data

Refer to the Accounting and Appropriate Data indicated above under Section G.

G-5 Payment/Invoices

(a) Vouchers - Original plus three (3) copies, identified by contract number, with supporting statements, shall be submitted monthly for review and provisional approval to the cognizant audit agency listed below:

Defense Contract Audit Agency
10500 Westmoor Drive
Westminster, CO 80021

(b) In addition to the above, one copy of each voucher submitted for payment shall be submitted to the Contracting Officer and the COR of this contract.

G-6 Payment Instructions for Multiple Accounting Classification Citations

Payments under contract line items funded by multiple accounting classification citations shall be made from the earliest available fiscal year funding sources. The earliest assigned ACRN must be fully disbursed before making disbursements from a succeeding ACRN.

G-7 Explanation of Limitation of Funds

The total estimated cost plus fixed fee of this contract as set forth in Section B shall be subject to incremental funding with $418,903.00 presently available for payment and allotted to this contract. (b)(4) (b)(4) The total funds allotted are expected to last through March 31, 2006. Except in accordance with the clause at FAR 52.232.22, "Limitation of Funds," no legal liability on the part of the Government for payment of any money in excess of $418,903.00 shall arise unless and until additional funds are made available by the Contracting Officer through written modification to this contract.

SECTION H Special Contract Requirements

H-1 Contracting Officer

Notwithstanding any other provision of this contract, the Contracting Officer is the only individual authorized to redirect the effort or in any way amend or modify any of the terms of this contract.

H-2 Type of Contract

This is a Cost Plus Fixed Fee, Completion contract.

H-3 Public Release or Dissemination of Information

(a) There shall be no dissemination or publication, except within and between the Contractor and any subcontractors, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval of the COR.

(b) All technical reports developed under the contract will be given proper review by appropriate authority to determine which distribution statement is to be applied prior to any distribution.

(c) When submitting material for clearance for open publication, the Contractor must submit five (5) copies to DARPA Security and Intelligence Directorate (SID) and allow for four (4) weeks for processing. If the paper is to be presented at a meeting, the contractor must indicate the subject and the exact date of the meeting, or deadline date, for submitting material. A full and final text of material requiring review, including any supplemental audiovisual material, shall be submitted. Notes, abstracts, outlines or viewgraphs shall not be cleared as substitutes for a complete text.

H-4 Invention Disclosures and Reports

The Contractor shall submit all invention disclosures and reports required by the Patent Rights clause of this contract to the Administrative Contracting Officer (ACO).

H-5 Restrictions on Printing

Unless otherwise authorized in writing by the Contracting Officer, reports, data, or other written material produced using funds provided by this contract and submitted hereunder shall be reproduced only by duplicating

processes and shall not exceed 5,000 single page reports or a total of 25,000 pages of a multiple-page report. These restrictions do not preclude the writing, editing, preparation of manuscript or reproducible copy of related illustrative materials if required as a part of this contract, or incidental printing such as forms or materials necessary to be used by the Contractor to respond to the terms of the contract.

H-6 Insurance Schedule

The Contractor shall maintain the types of insurance listed in FAR 28.307-2(a), (b) and (c), with the minimum amounts of liability therein. The types of insurance and coverage listed in paragraphs (d) and (e) shall also be maintained when applicable.

H-7 Metric System

(a) The Defense Advanced Research Projects Agency (DARPA) will consider the use of the metric system in all of its activities consistent with operational, economical, technical and safety requirements.

(b) The metric system will be considered for use in all new designs. When it is deemed not to be in the best interest of the DoD to provide metric design, justification shall be provided.

(c) Physical and operational interfaces between metric items and U.S. customary items will be designed to assure that interchangeability and interoperability will not be affected.

(d) Existing designs dimensioned in U.S. customary units will be converted to metric units only if determined to be necessary or advantageous. Unnecessary retrofit of existing systems with new metric components will be avoided where both the new metric and existing units are interchangeable and interoperable. Normally, the system of measurement in which an item is originally designed will be retained for the life of the item.

(e) During the metric transition phase hybrid metric and U.S. customary designs will be necessary and acceptable. Material components, parts, subassemblies, and semifabricated materials, which are of commercial design will be specified in metric units only when economically available and technically adequate or when it is otherwise specifically determined to be in the best interest of the Department of Defense. Bulk materials will be specified and accepted in metric units when it is expedient or economic to do so.

(f) Technical reports, studies, and position papers (except those pertaining to items dimensioned in U.S. customary units) will include metric units of measurement in addition to or in lieu of U.S. customary units. With respect to existing contracts, this requirement applies only if such documentation can be obtained without an increase in contract costs.

(g) Use of the dual dimensions (i.e., both metric and U.S. customary dimensions) on drawings will be avoided unless it is determined in specific instances that such usage will be beneficial. However, the use of tables on the document to translate dimensions from one system of measurement to the other is acceptable.

H-8 Proprietary Technical Data and Computer Software

Any deliverable technical data or computer software developed or generated solely at private expense and considered to be proprietary by the Contractor or subcontractors, shall be delivered in accordance with DFARS 252.227-7013 and DFARS 252.227-7014.

H-9 Key Personnel

(a) The Contractor shall notify the Contracting Officer prior to making any change in key personnel. Key personnel are identified as follows:

(1) Personnel identified in the proposal as key individuals to be assigned for participation in the performance of the contract;

(2) Personnel whose resumes were submitted with the proposal; or

(3) Individuals who are designated as key personnel by agreement of the Government and the Contractor during negotiations.

(b) The Contractor must notify the COR that the qualifications of prospective replacement personnel are equal to or better than the qualifications of the personnel being replaced. Notwithstanding any of the foregoing provisions, key personnel shall be furnished unless the Contractor has notified the COR of the qualifications of proposed substitute personnel, which are equal to or better than the qualifications of the personnel being replaced.

H-10 Consent to Subcontracts

Evaluation during negotiations of subcontractor cost or pricing data shall not satisfy the requirements for consent pursuant to FAR 52.244-02 Subcontracts (AUG 1998) and its Alternate I.

H-11 Travel

(a) Reimbursement for travel-related expenses shall be in accordance with the Contractor's approved travel policy. The Federal Travel Regulations, Joint Travel Regulations (JTR), and Standardized Regulations as stated in FAR 31.205-46 will be used as a guide in determining reasonableness of per diem costs. Costs for travel shall be allowable subject to the provisions of FAR 31.205-46.

(b) In connection with direct charge to the contract of travel-related expenses, the Contractor shall hold travel to the minimum required to meet the objectives of the contract, and substantial deviations from the amount of travel agreed to during contract negotiation shall not be made without the authorization of the Contracting Officer. When applicable, the Contractor shall notify the COR of proposed travel of an employee beyond that agreed to during negotiations.

(c) Approval of the Contracting Officer shall be obtained in advance for attendance by personnel at training courses, seminars, and other meetings not directly related to contract performance if the costs for the courses, seminars, and other meetings are charged to the contract.

(d) All foreign travel shall be authorized and approved in advance, in writing, by the Contracting Officer. Request for such travel must be submitted to the Contracting Officer at least forty-five (45) days in advance of traveler's anticipated departure date, and shall include traveler's itinerary of United States Flag Air Carriers.

H-12 Information Technology

(a) All Information Technology (IT) under this contract shall be "Year 2000 Compliant".

(b) IT, as used in this part, means all computer related hardware and/or software purchased and/or developed under this contract.

(c) "Year 2000 compliant," as used in this part, means, with respect to IT, that the IT accurately processes date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other IT, used in combination with the IT being acquired, properly exchanges date/time data with it.

H-13 Contractor's Representations and Certifications

The Contractor's Representations and Certifications are incorporated herein by reference and made part of this contract.

H-14 Performance Impact

In the event an Associate Contractor refuses, in writing, to deliver performance/data called for under the contract directly to the Contractor, the Contractor must notify the Contracting Officer immediately in writing upon notification from the Associate Contractor. The Contractor agrees that the Contracting Officer and Contracting Officer's Representative (COR) shall engage with the Associate Contractor to resolve pertinent issues in conjunction with the Contractor.

While the Contractor has responsibility for performance of the total X-NAV program, the Contractor shall be relieved of its obligation to furnish services relative to an Associate Contractor who fails to deliver; however, the Contractor shall work with the COR and Contracting Officer to fulfill that obligation through other venues, if possible. See Attachment 5 for performance impact based on tasks.

H-15 Go/No-Go Criteria for the XNAV team (BATC, LANL, JHU-APL, & NIST)

Phase I performance shall be evaluated on the basis of the Go/No-go criteria set forth below:

1. Successful demonstration of x-ray detector flux sensitivity (~10^{-5} to 10^{-6} ph/cm^2/s/KeV), response time (~10 to 100 ns), and timing electronics (<10 ns).

2. Successfully catalog properties of at least 10 known pulsar sources (plus any additional x-ray sources deemed useful), in the .1 to 20 KeV energy range, for use in for navigation (position and velocity), time, and attitude determination.

3. Successful demonstration of expected navigation performance via detailed laboratory simulation or hardware in the loop experiments (from ~10 m to 100 m SEP).

4. Deliverables consistent with a Preliminary Design Review (PDR) as defined in the BATC and Associate Contractor Statements of Work (SOW's). The XNAV PDR shall consist of the preliminary documents listed in the SOW, a conceptual design of the XNAV System (3-D CAD models only), and the presentation of the final report detailing the findings of the XNAV feasibility study.

5. Determine the proper orientation of the payload on the ISS Express Pallet (baseline platform) for optimum performance.

SECTION I Contract Clauses

CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	DEC 2001
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-6	Restrictions On Subcontractor Sales To The Government	JUL 1995
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 2003
52.204-2	Security Requirements	AUG 1996
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000

52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JUL 1995
52.211-15	Defense Priority And Allocation Requirements	SEP 1990
52.215-2 Alt II	Audit and Records--Negotiation (Jun 1999) - Alternate II	APR 1998
52.215-8	Order of Precedence--Uniform Contract Format	OCT 1997
52.215-10	Price Reduction for Defective Cost or Pricing Data	OCT 1997
52.215-11	Price Reduction for Defective Cost or Pricing Data--Modifications	OCT 1997
52.215-13	Subcontractor Cost or Pricing Data--Modifications	OCT 1997
52.215-14 Alt I	Integrity of Unit Prices (Oct 1997) - Alternate I	OCT 1997
52.215-15	Pension Adjustments and Asset Reversions	JAN 2004
52.215-16	Facilities Capital Cost of Money	JUN 2003
52.215-18	Reversion or Adjustment of Plans for Postretirement Benefits (PRB) Other than Pensions	OCT 1997
52.215-19	Notification of Ownership Changes	OCT 1997
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.216-7	Allowable Cost And Payment	DEC 2002
52.216-8	Fixed Fee	MAR 1997
52.219-8	Utilization of Small Business Concerns	OCT 2000
52.222-2	Payment For Overtime Premiums *(Note: The word "zero" is inserted in the blank spaces indicated by an asterisk)*	JUL 1990
52.222-3	Convict Labor	JUN 2003
52.222-21	Prohibition Of Segregated Facilities	FEB 1999
52.222-26	Equal Opportunity	APR 2002
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans	DEC 2001
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	DEC 2001
52.223-6	Drug-Free Workplace	MAY 2001
52.225-13	Restrictions on Certain Foreign Purchases	DEC 2003
52.227-1 Alt I	Authorization And Consent (Jul 1995) - Alternate I	APR 1984
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	AUG 1996
52.227-10	Filing Of Patent Applications--Classified Subject Matter	APR 1984
52.227-12	Patent Rights--Retention By The Contractor (Long Form)	JAN 1997
52.228-7	Insurance--Liability To Third Persons	MAR 1996
52.230-2	Cost Accounting Standards	APR 1998
52.230-6	Administration of Cost Accounting Standards	NOV 1999
52.232-9	Limitation On Withholding Of Payments	APR 1984
52.232-17	Interest	JUN 1996
52.232-22	Limitation Of Funds	APR 1984
52.232-23	Assignment Of Claims	JAN 1986
52.232-25	Prompt Payment	OCT 2003
52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	OCT 2003
52.233-1	Disputes	JUL 2002
52.233-3 Alt I	Protest After Award (Aug 1996) - Alternate I	JUN 1985
52.242-1	Notice of Intent to Disallow Costs	APR 1984
52.242-3	Penalties for Unallowable Costs	MAY 2001
52.242-4	Certification of Final Indirect Costs	JAN 1997
52.242-13	Bankruptcy	JUL 1995
52.242-15 Alt I	Stop-Work Order (Aug 1989) - Alternate I	APR 1984
52.243-2 Alt V	Changes--Cost-Reimbursement (Aug 1987) - Alternate V	APR 1984
52.243-6	Change Order Accounting	APR 1984
52.244-2 Alt I	Subcontracts (Aug 1998) - Alternate I	AUG 1998

52.244-5	Competition In Subcontracting	DEC 1996
52.245-5 (Dev)	Government Property (Cost-Reimbursement, Time-and-Material, and Labor-Hour Contracts) (Deviation)	JUN 2003
52.245-19	Government Property Furnished "As Is"	APR 1984
52.246-9	Inspection Of Research And Development (Short Form)	APR 1984
52.246-23	Limitation Of Liability	FEB 1997
52.247-1	Commercial Bill Of Lading Notations	APR 1984
52.247-34	F.O.B. Destination	NOV 1991
52.247-63	Preference For U.S. Flag Air Carriers	JUN 2003
52.249-6	Termination (Cost-Reimbursement)	MAY 2004
52.249-14	Excusable Delays	APR 1984
52.251-1	Government Supply Sources	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	MAR 1999
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004 Alt A	Required Central Contractor Registration Alternate A	NOV 2003
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7000	Acquisition From Subcontractors Subject To On-Site Inspection Under The Intermediate Range Nuclear Forces (INF) Treaty	NOV 1995
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Terrorist Country	MAR 1998
252.211-7003	Item Identification and Valuation	JAN 2004
252.215-7000	Pricing Adjustments	DEC 1991
252.225-7012	Preference For Certain Domestic Commodities	FEB 2003
252.225-7016	Restriction On Acquisition Of Ball and Roller Bearings	APR 2003
252.225-7025	Restriction on Acquisition of Forgings	APR 2003
252.227-7013	Rights in Technical Data--Noncommercial Items	NOV 1995
252.227-7014	Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation	JUN 1995
252.227-7015	Technical Data--Commercial Items	NOV 1995
252.227-7016	Rights in Bid or Proposal Information	JUN 1995
252.227-7019	Validation of Asserted Restrictions--Computer Software	JUN 1995
252.227-7027	Deferred Ordering Of Technical Data Or Computer Software	APR 1988
252.227-7030	Technical Data--Withholding Of Payment	MAR 2000
252.227-7036	Declaration of Technical Data Conformity	JAN 1997
252.227-7037	Validation of Restrictive Markings on Technical Data	SEP 1999
252.231-7000	Supplemental Cost Principles	DEC 1991
252.232-7003	Electronic Submission of Payment Requests	DEC 2003
252.235-7010	Acknowledgment of Support and Disclaimer	MAY 1995
252.235-7011	Final Scientific or Technical Report	SEP 1999
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.244-7000	Subcontracts for Commercial Items and Commercial Components (DoD Contracts)	MAR 2000
252.245-7001	Reports Of Government Property	MAY 1994
252.246-7000	Material Inspection And Receiving Report	MAR 2003
252.247-7023	Transportation of Supplies by Sea	MAY 2002
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000
252.251-7000	Ordering From Government Supply Sources	OCT 2002

*Remarks: At FAR 52.222, insert the word, "zero," in all spaces indicated by an asterisk (*).

CLAUSES INCORPORATED BY FULL TEXT

52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS (APR 2003)

(a) Definitions. As used this clause–

"Commercial item", has the meaning contained in the clause at 52.202-1, Definitions.

"Subcontract", includes a transfer of commercial items between divisions, subsidiaries, or affiliates of the Contractor or subcontractor at any tier.

(b) To the maximum extent practicable, the Contractor shall incorporate, and require its subcontractors at all tiers to incorporate, commercial items or nondevelopmental items as components of items to be supplied under this contract.

(c)(1) The Contractor shall insert the following clauses in subcontracts for commercial items:

(i) 52.219-8, Utilization of Small Business Concerns (OCT 2000) (15 U.S.C. 637(d)(2) and (3)), in all subcontracts that offer further subcontracting opportunities. If the subcontract (except subcontracts to small business concerns) exceeds $500,000 ($1,000,000 for construction of any public facility), the subcontractor must include 52.219-8 in lower tier subcontracts that offer subcontracting opportunities.

(ii) 52.222-26, Equal Opportunity (APR 2002) (E.O. 11246).

(iii) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era and Other Eligible Veterans (DEC 2001) (38 U.S.C. 4212(a)).

(iv) 52.222-36, Affirmative Action for Workers with Disabilities (JUN 1998) (29 U.S.C. 793).

(v) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (APR 2003) (46 U.S.C. Appx 1241 and 10 U.S.C. 2631) (flow down required in accordance with paragraph (d) of FAR clause 52.247-64).

(2) While not required, the Contractor may flow down to subcontracts for commercial items a minimal number of additional clauses necessary to satisfy its contractual obligations.

(d) The Contractor shall include the terms of this clause, including this paragraph (d), in subcontracts awarded under this contract.

52.247-67 SUBMISSION OF COMMERCIAL TRANSPORTATION BILLS TO THE GENERAL SERVICES ADMINISTRATION FOR AUDIT (JUN 1997)

(a)(1) In accordance with paragraph (a)(2) of this clause, the Contractor shall submit to the General Services Administration (GSA) for audit, legible copies of all paid freight bills/invoices, commercial bills of lading (CBL's), passenger coupons, and other supporting documents for transportation services on which the United States will assume freight charges that were paid (i) by the Contractor under a cost-reimbursement contract, and (ii) by a first-tier subcontractor under a cost-reimbursement subcontract thereunder.

(2) Cost-reimbursement Contractors shall only submit for audit those CBL's with freight shipment charges exceeding $50.00. Bills under $50.00 shall be retained on-site by the Contractor and made available for GSA on-site audits. This exception only applies to freight shipment bills and is not intended to apply to bills and invoices for any other transportation services.

(b) The Contractor shall forward copies of paid freight bills/invoices, CBL's, passenger coupons, and supporting documents as soon as possible following the end of the month, in one package to the General Services Administration, ATTN: FWA, 1800 F Street, NW, Washington, DC 20405. The Contractor shall include the paid

freight bills/invoices, CBL's, passenger coupons, and supporting documents for first-tier subcontractors under a cost-reimbursement contract. If the inclusion of the paid freight bills/invoices, CBL's, passenger coupons, and supporting documents for any subcontractor in the shipment is not practicable, the documents may be forwarded to GSA in a separate package.

(c) Any original transportation bills or other documents requested by GSA shall be forwarded promptly by the Contractor to GSA. The Contractor shall ensure that the name of the contracting agency is stamped or written on the face of the bill before sending it to GSA.

(d) A statement prepared in duplicate by the Contractor shall accompany each shipment of transportation documents. GSA will acknowledge receipt of the shipment by signing and returning the copy of the statement. The statement shall show--

(1) The name and address of the Contractor;

(2) The contract number including any alpha-numeric prefix identifying the contracting office;

(3) The name and address of the contracting office;

(4) The total number of bills submitted with the statement; and

(5) A listing of the respective amounts paid or, in lieu of such listing, an adding machine tape of the amounts paid showing the Contractor's voucher or check numbers.

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): http://www.arnet.gov/far

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any N/A (48 CFR N/A) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

SECTION J List of Documents, Exhibits and Other Attachments

Attachment 1	Statement of Work for Ball Aerospace
Attachment 2	Statement of Work for Associate Contractors
Attachment 3	Contract Deliverables Schedule
Attachment 4	Advance Agreement to Authorize Incurrence of Precontract Costs
Attachment 5	Performance Impact based on Tasks

STATEMENT OF WORK

1.0 PURPOSE AND SCOPE

1.1 Purpose

This Statement of Work (SOW) defines the effort required to manage the development of: a conceptual design and cost estimate for X-ray pulsar cataloging and modeling (Task 1); design, development, and characterization of an X-ray detection and imaging subsystem (Task 2); design and development of navigation algorithms (Task 3); and performance of integrated system design and mission studies for Phase I of the XNAV Program. The XNAV program is performed in conjunction with NIST, LANL, and JHU/APL under separate contract vehicles. Procurement requirements shall be as specified herein and in the detection and imaging
(b)(4) subsystem (b)(4) Technical Requirements Document
(b)(4) (TRD). The (b)(4) are to be designed, manufactured, and jointly tested by the Los Alamos National Laboratory, Johns Hopkins Applied Physics Laboratory, National Institute of Standards & Technology ("LANL", "JHU-APL", "NIST", or "Associate Contractors"), and Ball Aerospace & Technologies Corporation ("BATC" or "Contractor") for the Defense Advanced Projects Agency ("DARPA" or "Customer") to ultimately provide an autonomous backup navigation system for military navigation and communication satellites.

1.2 Scope

BATC agrees to furnish personnel, services, materials, equipment, and facilities necessary to develop an integrated system design and mission studies; and to assist LANL, JHU-APL, and
(b)(4) NIST in the development of a conceptual design and cost estimate for the (b)(4) pulsar cataloging and modeling, and navigation algorithm development in accordance with the requirements of this SOW and the documents referenced herein. The XNAV Program is structured in three phases:

- Phase I: Conceptual Design and Feasibility Study
- Phase II: Prototype Development and Test
- Phase III: System Development and Demonstration in Operational Environment

This SOW provides a detailed specification of the work to be performed by BATC during Phase I. Detailed statements of work for Phases II and III will be provided if requested by the Government.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this SOW to the extent specified herein. Unless a specific issue or revision is listed, the referenced documents shall be of that issue or revision in effect on the date of request for proposal:

(b)(4) • X-ray (b)(4) Technical Requirements Document (TRD) (Note: The TRD is a non-deliverable item whose content is an extraction of performance goals from the DARPA XNAV BAA. The performance estimates of the XNAV system will be continually updated and the TRD will be informally maintained.)

3.0 SPECIFIC TASKS

Reports, data, hardware, and software generated during this phase will be delivered to DARPA. For Phase I, the maturity level of the deliverable items is described in section 4.

3.1 Program Management

BATC will designate a Program Manager with authority to plan and direct the successful and timely performance of the work specified within this SOW.

Technical - System-Level
BATC, with the assistance of LANL, JHU-APL, and NIST, agrees to develop the following system-level tasks during Phase I of the XNAV Program.

3.1.1 Mission Analyses

BATC agrees to develop mission analyses, e.g., development of the system architecture, Concept of Operations (CONOPS), mission operations timelines, command & control structure, modes of communication, and contingency operations plans.

3.1.2 System Requirements Definition

BATC agrees to develop the system requirements definition, e.g., system requirements development, decomposition, and functional allocation down to the subsystem level. This information is captured in the Systems Requirement Document (SRD).

3.1.3 System Conceptual Design

BATC agrees to perform the development and evaluation of the system conceptual design, e.g., identification of critical issues, key performance parameters, and system trades associated with achieving the required overall system performance levels.

3.1.4 System Trade Studies

BATC agrees to develop the system trade studies, e.g., Modeling & Simulation (M&S) efforts, performance assessments, Cost as An Independent Variable (CAIV) studies, as applicable.

3.1.5 System Development Planning

BATC agrees to perform the system development planning, e.g., resource allocation, personnel and facilities scheduling, long-lead item identification, vendor assessment/ selection.

3.1.6 System Integration and Test Planning

BATC agrees to develop the system integration and test planning, e.g., interface definition and control, resource allocation, personnel and facilities scheduling, transportation and logistics planning, test equipment identification, special materials handling and storage.

3.1.7 System Risk Management Planning

BATC agrees to develop the system risk management planning, e.g., technology maturity assessments, system risk identification and assessments, risk reduction methods, risk probability and consequence analyses.

3.1.8 System Cost Estimation

BATC agrees to develop the system cost estimation efforts, e.g., design costs, development costs, integration and test costs, security costs, management costs, accounting costs.

3.1.9 Planning for Phases II and III

BATC agrees to develop planning for Phases II and III during Phase I, if applicable. This includes top-level feasibility and design studies.

3.2 Sub-System Level

BATC agrees to assist the Associate Contractors, LANL, JHU-APL, and NIST, in the following subsystem-level efforts for XNAV Phase I, Task 1: pulsar cataloging and modeling; Task 2, X-ray detector conceptual design, development, and characterization (b)(4) and Task 3, navigation algorithm development. BATC agrees to develop the integrated systems design and mission studies, Task 4, with the assistance of the Associate Contractors.

(b)(4)

3.2.1 Task 1: Pulsar Cataloging and Modeling

BATC agrees to assist the Associate Contractors (i.e. LANL) to perform the following:

3.2.1.1 Pulsar Catalog Generation

Compile a list of candidate navigation pulsars. The catalog will contain positions, profiles and ephemeris information for the candidate pulsars.

3.2.1.2 Pulsar Physics Limitation Characterization

Characterize any known physics limitations to the cataloged pulsars that will affect their usefulness as navigation tools. This includes characterizing timing noise, energy intensity, glitches, pulsar variations, and developing characterization models as applicable.

3.2.1.3 Pulsar Timing Model Development

Develop models that include issues associated with time transfer, relativistic effects, and inertial reference frame variations. Techniques associated with accurate pulsar profile intensity modeling will be developed to quantify pulse time of arrival, shape, phase properties, and frequency to high resolution in time.

3.2.2 Task 2: X-Ray Detector Design

BATC agrees to assist the Associate Contractors (i.e. LANL) to perform the following:

3.2.2.1 Detector Technology Selection

(b)(4)
(b)(4)

Determine which technology, (b)(4) will be pursued for the XNAV [redacted] instrument and submit a report outlining the decision. This decision will determine which technology will be studied for the remainder of Phase I studies.

b4

3.2.2.2 (b)(4) Requirements Definition
Define the (b)(4) requirements, e.g., subsystem requirements development, decomposition, and functional allocation down to the subsystem level.

3.2.2.3 (b)(4) Conceptual Design
Develop and evaluate the (b)(4) conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

3.2.2.4 (b)(4) Trade Studies
Perform (b)(4) trade studies, e.g., subsystem Modeling & Simulation (M&S) efforts, performance assessments, Cost as An Independent Variable (CAIV) studies, as applicable.

3.2.2.5 (b)(4) Development Planning
Develop plans for (b)(4) development, e.g., subsystem resource allocation, personnel and facilities scheduling, long-lead item identification, vendor assessment/selection.

3.2.2.6 (b)(4) Integration and Test Planning
Developing concepts for (b)(4) integration and test, e.g., subsystem interface definition and control, resource allocation, personnel and facilities scheduling, transportation and logistics planning, test equipment identification, special materials handling and storage. This includes the development of a draft detector flight qualification plan and draft engineering development unit (EDU) integration and test plan.

3.2.2.7 (b)(4) Risk Management Planning
Developing plans for managing (b)(4) risks, e.g., subsystem technology maturity assessments, risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

3.2.2.8 (b)(4) Cost Estimation
Develop (b)(4) cost estimates, e.g., subsystem design costs, development costs, integration and test costs, security costs, management costs, accounting costs.

3.2.2.9 (b)(4) Science Model Building and Testing
Design, build, construct, and test the operation of a laboratory science model to develop and demonstrate the feasibility of the technology chosen for the (b)(

3.2.3 Task 3: Navigation Algorithm Development
BATC agrees to assist the Associate Contractors (i.e. JHU-APL) to perform the following:

3.2.3.1 Navigation Algorithm Requirements Definition
Define the Navigation Algorithm requirements, e.g., algorithm, modeling, and simulation requirements development, decomposition, and functional allocation.

3.2.3.2 Navigation Algorithm Trade Studies

Develop navigation algorithm trade studies, e.g., determine tradeoff between orbital instability and the observation time required to detect pulsars of interest.

3.2.3.3 Navigation Algorithm Risk Management Planning

Develop plans for managing navigation algorithm development risks, e.g., risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

4.0 DELIVERABLES

BATC agrees to deliver the following to DARPA, XNAV Phase I Contract Deliverables.

4.1 Phase I, Task 4 – Integrated System Design and Mission Studies

4.1.1 Integrated System Design

BATC agrees to provide, with the Associate Contractors' assistance, the following documents. These documents shall exhibit a preliminary design consistent with the tailored PDR.

4.1.1.1 Interface Control Document

BATC will generate a preliminary Interface Control Document (ICD) to define operational, functional, mechanical, thermal, and other critical interfaces between components and software of the XNAV system design. The ICD will also address the interfaces necessary to integrate the XNAV system with the host platform, be it the baselined International Space Station (ISS) Express Pallet or a free-flyer spacecraft. Computer Aided Design (CAD) Models of the designs and layouts will be developed to identify interfaces but detailed drawings will not be included in the ICD in Phase I of the Program.

4.1.1.2 Systems Requirements Document

BATC will generate a preliminary Systems Requirements Document (SRD) to identify mission objectives and define operational and functional requirements of the XNAV system that must be met in order to achieve the objectives of this new navigational system. The SRD will also address the requirements necessary for the XNAV system to operate as specified on the host platform (the baseline is the ISS Express Pallet).

4.1.1.3 Traceability Matrix

BATC will generate a preliminary Traceability Matrix to track the allocation of operational and functional requirements and their derivatives as identified in the Systems Requirements Document for the XNAV system.

4.1.1.4 CONOPS

BATC will generate a preliminary Concept of Operations (CONOPS) document to provide a baseline approach to the mission, ground system, and operation objectives for the XNAV system. It will provide an understanding of how the mission operations system will work to plan, conduct, and evaluate program operations. This document will be revised and updated as the program progresses to capture the design and mission improvements and/or iterations that will occur during Phase I of the program.

4.1.1.5 Integration & Test Plan

BATC will generate a preliminary Integration & Test (I&T) Plan to address the integration of the subsystems and software making up the XNAV system and to test these systems independently, and as a whole, to ensure the system meets the SRD requirements verifiable by test.

4.1.1.6 Risk Mitigation Plan

BATC will generate a preliminary Risk Mitigation Plan (RMP) to address and rank the risks identified by the program as technical, programmatic, cost, and schedule risks. The RMP will identify, assess and provide mitigation strategies for all risks deemed appropriate to track by the program. This document will be revised and updated as the program progresses while retiring these risks in the appropriate phase of the program.

4.1.1.7 Detector/Imager System Design

BATC will produce a preliminary system design for the Detector/Imager System that meets the operational and functional requirements specified in the SRD. Computer Aided Design (CAD) Models of the designs and layouts will be provided but detailed drawings will not be provided in Phase I of the program. Detailed drawings will be provided in Phase II of the program

4.1.2 Mission Study

4.1.2.1 Candidate Missions Study

BATC will perform mission studies on two mission types to assess the qualitative and quantitative impacts on the X-ray navigation system performance. The utility of the XNAV system will be evaluated for a deep space mission and a low earth orbit (LEO) mission. These studies will examine such qualitative impacts as field-of-view requirements, calibration, checkout, telemetry, state-of-health monitoring, spacecraft data management, and commanding that will be required with the addition of an X-ray navigation system. Using the results of the trade and mission studies, a conceptual design will be developed for an X-ray sensor that optimizes performance for all mission types.

4.2 Phase I, Task 4, Final Report

BATC agrees to provide the Phase I Final Report (Task 4) at the conclusion of the contract. This report shall include an executive summary of the Phase I task 4 activities identified in this SOW and the set of the deliverable items defined in section 4.1. Note: The documents delivered are expected to be at preliminary level as specified in paragraph 4.1. This report may be provided at the PDR or at a later date. The final report will be provided in color hardcopy (3 copies bound and 1 unbound, each) and electronic forms (on CD-ROM), using the following formats: MS Word format for the Phase I Final Report, MS PowerPoint format for the Phase I Final Briefing, Solid Works format preferred for the Computer Aided Design (CAD) models, Adobe Illustrator format preferred for graphics, MS Project format preferred for schedules, MS Excel format preferred for costs.

4.3 Phase I, Preliminary Design Review (PDR)

BATC shall coordinate and lead a PDR at the conclusion of the Phase I contract. The XNAV PDR is defined as the following: 1) the preliminary documents listed in the BATC and Associate Contractor SOW's, 2) a conceptual design of the XNAV System (3-D CAD models only), and 3)

the presentation of the final report detailing the findings of the XNAV feasibility study. Each Associate Contractor (LANL, JHU-APL, NIST) shall present their respective findings of the Phase I feasibility study for the XNAV program. The material provided in the XNAV PDR is preliminary in design detail with the BATC deliverables identified in paragraph 4.1. All Associate Contractor deliverables are explicitly defined in their respective SOW's. Sufficient emphasis shall be given in areas (e.g. X-ray detector) needed to proceed to the next phase of the contract. Because of significant uncertainties associated with the launch vehicle selection, the payload platform (Space Station Express pallet), and the operational environment, the PDR will be constrained to conceptual designs (CAD models) of the XNAV system. Many of the typical PDR tasks and deliverables (i.e. drawings) are planned for later phases of the program. The briefing shall be available in Power Point format.

4.4 Program Reviews and Meetings

Program Kick-Off
Conceptual Design Review - CoDR
PDR - Final Report Presentation (Defined by Section 4.3)

5.0 PERFORMANCE IMPACT

BATC acknowledges that its lack of performance, to include, but not be limited to, inability to meet schedule and technical and cost requirements, will adversely affect the ability of its three Associate contractors to successfully meet their obligations in XNAV Phase I Tasks 1, 2, 3, and 4. A table of potential impacts is shown in contract Attachment #5.

~ End ~

STATEMENT OF WORK FOR ASSOCIATE CONTRACTORS

National Institute of Standards and Technology (NIST) Task Statement

The NIST research objectives for Timing and Navigation support for X-ray Source Navigation (XNAV) are to:

(1) Establish the time accuracy and stability criteria requirements for the on-board master clock for XNAV,
(2) Design the best method of profiling, defining, and time-tagging the time-of-arrival (TOA) of the defined phase center in the group velocity of received, periodic plane-wave "pulses" from pulsars, and
(3) Work with Johns Hopkins University - Applied Physics Laboratory (JHU-APL) to provide the most accurate navigation solution under various signal-to-noise constraints.

The Contractor agrees to support Ball Aerospace Technologies Corporation (BATC) with the system requirements definition; e.g., system requirements development, decomposition, and functional allocation down to the subsystem level, as follows:

1) Simulate the reception of time-tagged pulses from other pulsars using available Crab data to develop models; estimate required integration times for navigation with various high-to-marginal photon detection rates in energy range of interest. These simulations will be used to develop requirements for the space-qualified clock(s) for timing pulse arrival time,

2) Study the signal-to-noise and signal acquisition constraints, establish and track timing requirements, and define the trade-off in position accuracy. The results of this activity will be flowed to JHU-APL for use in navigation algorithm development.

The Contractor agrees to assess the XNAV mission viability of the laboratory science model developed by Los Alamos National Laboratory (LANL). NIST will act in a capacity to recommend, support, and verify on-board operational systems as constituted by BATC, LANL, and JHU-APL.

The Contractor agrees to assist LANL in their efforts to develop approaches necessary for the estimation of phase from weak pulsars.

The Contractor agrees to assist LANL in developing a method of locating, in time, the peak (or phase center) in the group velocity of received, periodic plane-wave "pulses" from pulsars.

(b)(4) The Contractor agrees to assist BATC and LANL in the development and evaluation of the [redacted] conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

The Contractor agrees to support JHU-APL by evaluating XNAV attitude, navigation, and pulsar tracking requirements and algorithms. In addition, NIST will perform a time stability analysis required for an on-board master clock versus navigation performance criteria.

The Contractor will provide recommendations to BATC for the procurement of an on-board clock system for Phase II, if applicable. This clock will be included in the on-board validation system. If there are issues that limit clock performance, other options will be evaluated.

The Contractor agrees to assist BATC in the development and evaluation of the on-board validation subsystem conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

Deliverables

The Contractor will support BATC and the associate contractors in the production of deliverable items associated with the Final Report. NIST will act as a contributing editor to the XNAV Phase I Final Report deliverable from BATC to DARPA.

The Contractor agrees to assist BATC and LANL in the delivery to BATC of a Draft Detector Design Report that contains a conceptual design for the XNAV system.

Los Alamos National Laboratory (LANL)
Task Statement

The Contractor shall:

Compile a list of candidate navigation pulsars. The catalog will contain positions, profiles and ephemeris information for the candidate pulsars.

Characterize any known physics limitations to the cataloged pulsars that will affect their usefulness as navigation tools. This includes characterizing timing noise, energy intensity, glitches, pulsar variations, and developing characterization models as applicable.

Develop models that include issues associated with time transfer, relativistic effects, and inertial reference frame variations. Techniques associated with accurate pulsar profile intensity modeling will be developed to quantify pulse time of arrival, shape, phase properties, and frequency to high resolution in time.

(b)(4) Determine which technology [redacted] will be pursued for the XNAV (b)(4) instrument and submit a report outlining the decision. This decision will determine which technology will be studied for the remainder of Phase I studies.

Define the (b)(4) requirements, e.g., subsystem requirements development, decomposition, and functional allocation down to the subsystem level.

(b)(4) Develop and evaluate the [redacted] conceptual design, e.g., subsystem identification of critical issues, key performance parameters, and subsystem trades associated with achieving the required overall subsystem performance levels.

(b)(4) Perform [redacted] trade studies, e.g., subsystem Modeling & Simulation (M&S) efforts, performance assessments, Cost as An Independent Variable (CAIV) studies.

(b)(4) Develop plans for [redacted] development, e.g., subsystem resource allocation, personnel and facilities scheduling, long-lead item identification, vendor assessment/selection.

(b)(4) Develop concepts for [redacted] integration and test, e.g., subsystem interface definition and control, resource allocation, personnel and facilities scheduling, transportation and logistics planning, test equipment identification, special materials handling and storage. This includes the development of a draft detector flight qualification plan and draft engineering development unit (EDU) integration and test plan.

Develop plans for managing (b)(4) risks, e.g., subsystem technology maturity assessments, risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

Develop (b)(4) cost estimates, e.g., subsystem design costs, development costs, integration and test costs, security costs, management costs, accounting costs.

Develop representative algorithms to process data from the (b)(4) to best support the XNAV mission.

Assist with the development of the design and identification of risks involved in the readout electronics needed for the (b)(4)

Design, build, construct, and test the operation of a laboratory science model to develop and demonstrate the feasibility of the technology chosen for the (b)(4)

Deliverables

- Catalog of pulsars
- Supplemental radio observation plan
- Detector technology platform selection
- Prototype breadboard detector hardware
- Draft detector flight qualification plan
- Preliminary flight detector design

Johns Hopkins University Applied Physics Laboratory
Task Statement

I. With respect to Task 2 of Phase I of the XNAV Program, the Contractor shall:

Task APL-1. Develop a conceptual design for the readout electronics for the (b)(4) sensor that is consistent with the system requirements of the (b)(4), (b)(5)

(b)(4)

To accomplish Task APL-1, the contractor shall also:

Assist LANL and BATC in sensor (b)(4) requirements definition, trade studies, development planning, integration and test planning, risk management planning, cost estimation, data processing algorithm development, and science model building and testing.

II. With respect to Task 3 of Phase I of the XNAV Program, the Contractor shall:

Task APL-2. Develop a conceptual design for tracking signals from X-ray pulsars, and develop algorithms that will use these time difference of arrival (TDOA) measurements for spacecraft navigation. The conceptual design will be based on the use of phase-locked loop techniques, developed in conjunction with wavelet transforms under investigation by NIST, in order to coherently and synchronously track pulsars using the photon measurements provided by the (b)(4) via the sensor readout electronics.

(b)(4)

To accomplish Task APL-2, the contractor shall also:

Define the Navigation Algorithm requirements, e.g., algorithm, modeling, and simulation requirements development, decomposition, and functional allocation.

Develop navigation algorithm trade studies, e.g., determine tradeoff between orbital instability and the observation time required to detect pulsars of interest.

Develop plans for navigation algorithm development, e.g., use mathematical analysis supported by simulation using standard software tools such as Matlab, to ascertain and quantify the effectiveness of the various algorithmic approaches for use in space borne X-ray navigation systems.

Develop plans for managing navigation algorithm development risks, e.g., risk identification and assessment, risk reduction methods, risk probability and consequence analyses.

Develop Navigation Algorithm cost estimates, e.g., design and development costs, security costs, management costs, accounting costs.

Task APL-3. Develop a conceptual design, using sensor characteristics provided by LANL, for an attitude determination algorithm based on sensor pointing angles.

To accomplish Task APL-3, the contractor shall also:

Define algorithm requirements.

Perform trade studies, development planning, risk management planning, and cost estimation.

Relate these parameters to the navigation algorithms developed in Task 1 for time difference of arrival measurements.

Task APL-4. Develop prototype demonstration software for the TDOA and Attitude Determination Algorithms.

To accomplish Task APL-4, the contractor shall also:

Design a conceptual architecture for the software required to execute the navigation and attitude determination algorithms developed during Phase I.

Develop prototype software, as indicated in a Software Development Plan, to demonstrate for the purposes of Phase I, the ability to ultimately develop flight software for a spacecraft demonstration in Phases II and III, if applicable. The prototype software will demonstrate the utility and scalability of the conceptual architecture when used to process data obtained from the (b)(4) (b)(4)

Develop a conceptual design for extensions to the navigation algorithms. These extensions will smooth noise and further improve the navigation performance of the conceptual X-ray navigation algorithms.

Task APL-5. Implement the conceptual TDOA algorithm design, in hardware and/or software, for the purpose of enabling a time difference of arrival test using measured data from an X-ray sensor that detects a simulated pulsar signal.

Deliverables

- Conceptual Readout Electronics Design Plan.
- Conceptual Readout Electronics Design Final Report.
- Conceptual Navigation Algorithms Report, detailing pulsars of interest as a function of orbital parameters, and computations of expected pulsar signals based on the (b)(4) specifications and characteristics of known Xray pulsars.
- Software Development Plan for attitude and TDOA measurements
- Pulsar Tracking Algorithms Report, including algorithms based on TDOA measurements.
- Software Architecture Report for TDOA measurements, including optimized versions using Kalman filter or other optimized techniques.
- Attitude Navigation Algorithms Report,including mapping of S/C position & time to sensor pointing angles.
- Experimental hardware and/or software for end-to-end demonstration of TDOA capabilities using X-ray sensor measurements of a simulated X-ray pulsar.
- Optimized Navigation Algorithms Final Report, included aided and non-aided acquisition and reacquisition of signals from X-ray pulsars, and a test plan for the end-to-end experiment described in Task 6 above.

~ End ~

DELIVERABLES

TITLE	DUE DATE (MONTHS AFTER AWARD)
Preliminary Interface Control Document	October 15, 2006
Preliminary Systems Requirements Document	October 15, 2006
Preliminary Traceability Matrix	October 15, 2006
Preliminary CONOPS	October 15, 2006
Preliminary Integration and Test Plan	October 15, 2006
Preliminary Risk Mitigation Plan	October 15, 2006
Preliminary Detector/Imager System Design	October 15, 2006
Preliminary Candidate Missions Study	October 15, 2006

ADVANCE AGREEMENT TO AUTHORIZE INCURRENCE OF PRECONTRACT COSTS UNDER CONTRACT NUMBER HR0011-05-C-0129

The subject Precontract Cost Agreement is extended through July 31, 2005. All other terms and conditions remain unchanged.

July 1, 2005
DATE

(b)(6)
Contract Manager
Defense Operations

7/6/05
DATE

(b)(6)
Contracting Officer

ADVANCE AGREEMENT TO AUTHORIZE INCURRENCE OF PRE-AWARD COSTS

REFERENCE: Ball Aerospace and Technologies Corporation's Proposal entitled, "X-ray Source Navigation for Autonomous Position Determination Program (XNAV)," dated October 18, 2004

Defense Advanced Research Projects Agency (DARPA), Contracts Management Office (CMO), has received a valid and properly funded requirement for Ball Aerospace and Technologies Corporation to research and demonstrate X-ray Source Navigation for Autonomous Position Determination Program (XNAV), Phase I.

Since the Contracting Officer has determined that incurrence of costs before the effective date of the contract is necessary to ensure compliance with the proposed delivery schedule, the Government and the Contractor agree as follows:

FIRST: In the event a contract is awarded, pre-award costs, not to exceed $100,000 shall be allowable expense, provided that the individual costs therein shall be

(a) otherwise allowable, reasonable, and allocable;
(b) incurred no sooner than May 17, 2005 and no later than June 30, 2005; and
(c) incurred specifically and exclusively to accomplish work described in the Statement of Work contained in the above referenced proposal.

SECOND: Contract specifications and price(s) shall be agreed to by the earlier of:

(a) June 30, 2005; or,
(b) the date on which the amount of funds obligated, committed or expended under this Advance Agreement is equal to no more than $100,000.

THIRD AND FINALLY: It is the intention of the Government to award a contract to the Contractor, subject to final agreement on terms, specifications and price(s), which contract shall incorporate this Advance Agreement. It is understood and agreed by both parties that this Agreement concerns the treatment of pre-award costs in the event of award of a contract. This Agreement does not require the Contractor to incur any such costs, and any costs incurred are at the risk of the Contractor, pending the award of a contract.

For the Contractor:

J. Michael Cerneck
VP & GM Defense Operations

5/19/05
(Date)

For the Government:

(b)(6)

Defense Advanced Research Projects Agency
Contracts Management Office

5/26/05
(Date)

PERFORMANCE IMPACT PER TASK

TASK	RESPONSIBILITY	ASSISTANCE REQUIRED	DELIVERABLE	IMPACT OF FAILED ASSISTANCE
Interface Definitions	BATC	ALL	Preliminary Interface Control Document	BATC is dependent upon the three Associate Contractors (AC's) to Identify Interface Information. Minimal work can be accomplished without this information.
System Requirements Definition	BATC	ALL	Preliminary Systems Requirements Document	The AC's will provide subsystem and system requirements to BATC. These will be tracked against the program KPP's. BATC will be prevented from tracking the system performance without the AC's support.
Requirements Traceability	BATC	ALL	Preliminary Traceability Matrix	See note above
CONOPS Development	BATC	ALL	Preliminary CONOPS	A notional CONOPS can be developed independent of the AC's. However, without their assistance BATC cannot provide a fully coordinated, system level CONOPS approach.
Integration and Test Planning	BATC	ALL	Preliminary Integration and Test Plan	A notional I&T Plan can be developed Independent of the AC's. However, without their assistance BATC cannot provide an adequately detailed I&T Plan for the XNAV system.
Risk Assessment and Mitigation	BATC	ALL	Preliminary Risk Mitigation Plan	BATC can identify some of the Risks associated with the X-ray sensor system. However, without the AC's assistance, BATC cannot identify all of the risks or provide detailed mitigation plans.
Draft Detector/Imager System Design	BATC	ALL	Preliminary Detector/Imager System Design	BATC can formulate a conceptual Detector/Imager system design. However without the AC's assistance BATC cannot identify all of the design parameters or provide subsystem information.
Candidate Mission Analysis	BATC	ALL	Preliminary Candidate Missions Study	This task has some dependence to the CONOPS development and the instrument performance. The analysis cannot be adequately completed without the AC's assistance.
Final Report	BATC	ALL	Final Report	BATC is dependent upon the AC's for a majority of information contained in the final report. Minimal work can be accomplished without their assistance.
Preliminary Design Review (PDR)	BATC	ALL	PDR Presentation	Same as final report note (The PDR submissions is limited to the deliverables identified in the respective AC SOW's)